THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVII. No. 1728.] LONDON, JUNE 23, 1896. [48TH YEAR. PRICE 6d.

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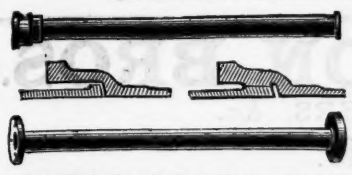

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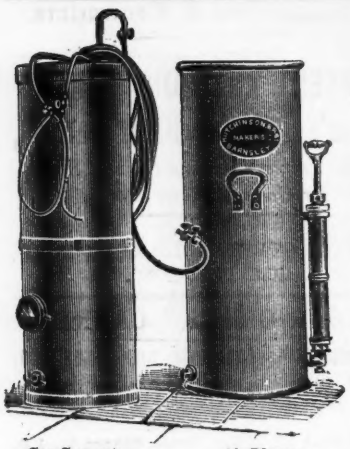

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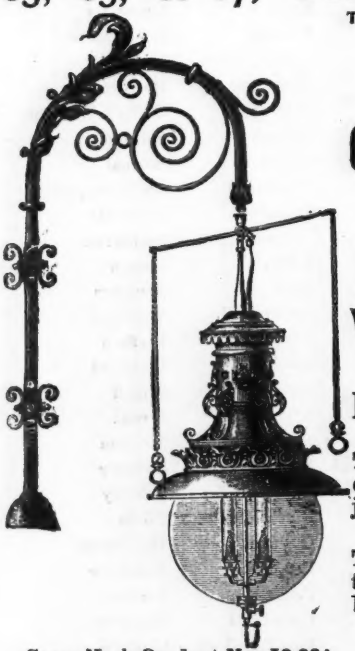

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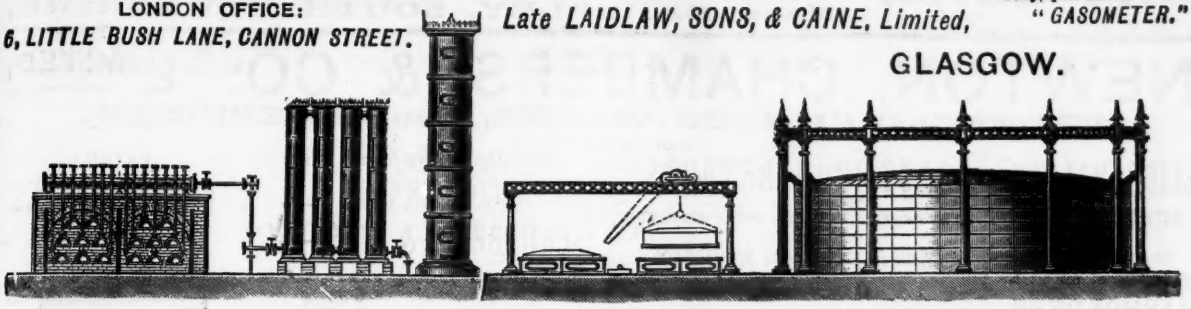

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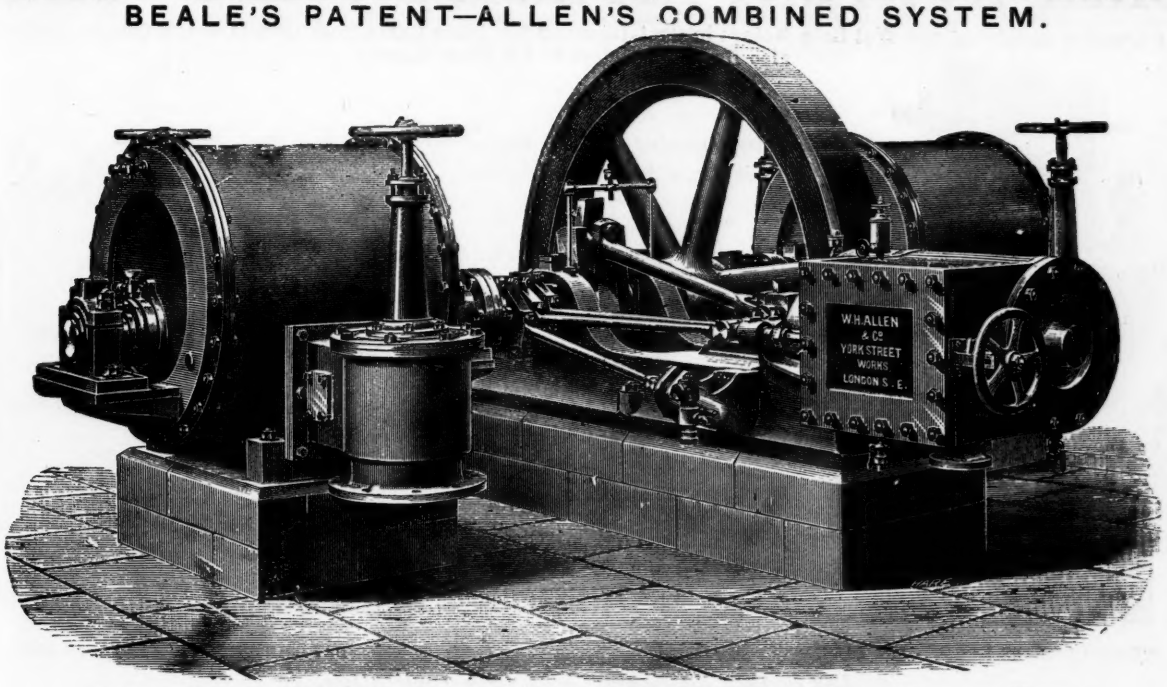

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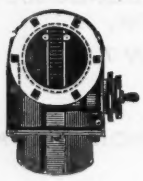

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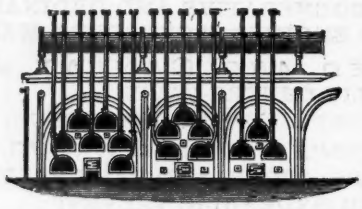

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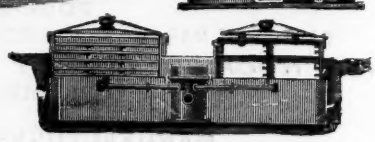

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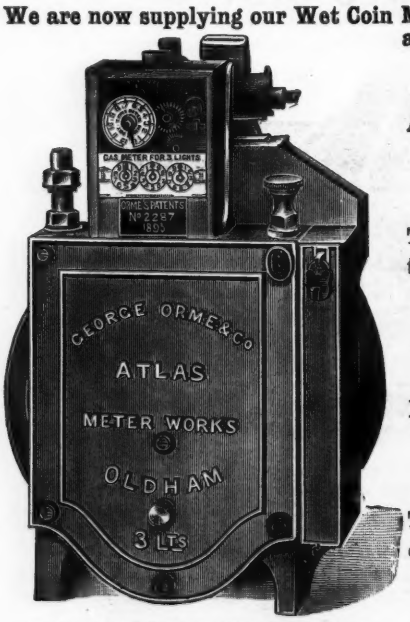

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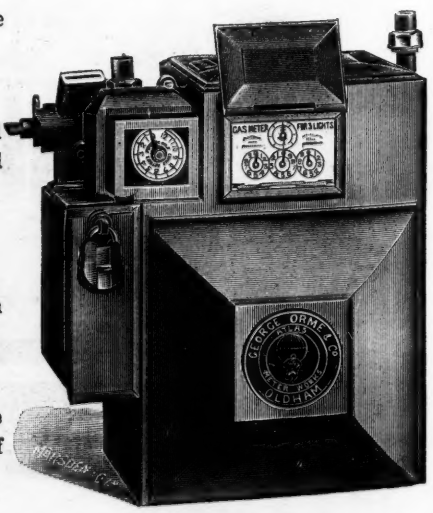

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1894	Sligo Gas Company	3	All	50	54
1891	Cie L'Union des Gaz Milan	2	All	116	46
1892	Bathurst (N.S.W)	2	All	82	36
1895	Athens (Greece)	2	All	64½	42
1890	Tyne Dock Gas-Wks., N.E.Ry.	2	All	71	42
1890	Newburn-on-Tyne	2 & Tank	All	47½	52½
1894	St. Austell Gas Company	2	All	34	34
1894	Birkenhead Corpn.	4	2 Top	160	120
1894	Cape Town (S. Africa)	3	Do.	50	48
1892	Nottingham Corpn.	4	1 Top	100	100
1892	Nottingham Corpn.	4	1 Top	90½	100
1893	Do.	4	Do.	90½	100
1893	Do.	4	Do.	90½	100
1890	Manchester Cor. (Gaythorn Wks.)	3	Do.	130	90
1890	Do. Do.	3	Do.	100	75
1890	Do. Do.	3	Do.	100	75
1889	Do. (Rochdale Road)	3	Do.	100	75
1891	Darlington Corpn.	3	Do.	100	73½
1895	Barrow-in-Furness	2	Do.	100	41
1889	Haslingden Union Gas Company	2	Do.	80	44
1894	Selby Local Board	2	Do.	50	36
1896	Stone Gaslight Company	3	All	42	48

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Perth Corpn.	2 Do.	Do.	125	50
Barcelona (Spain)	2	Do.	98½	52
Perth (W. Australia)	2 & Tank	Do.	75	40
Derby Gaslight Co.	4	Top	125	102
Birmingham Corpn.	1		80	20
Malvern	2	Both	120	48
Preston Mills	2	Both	48	36
Brest (France)	1		43	13

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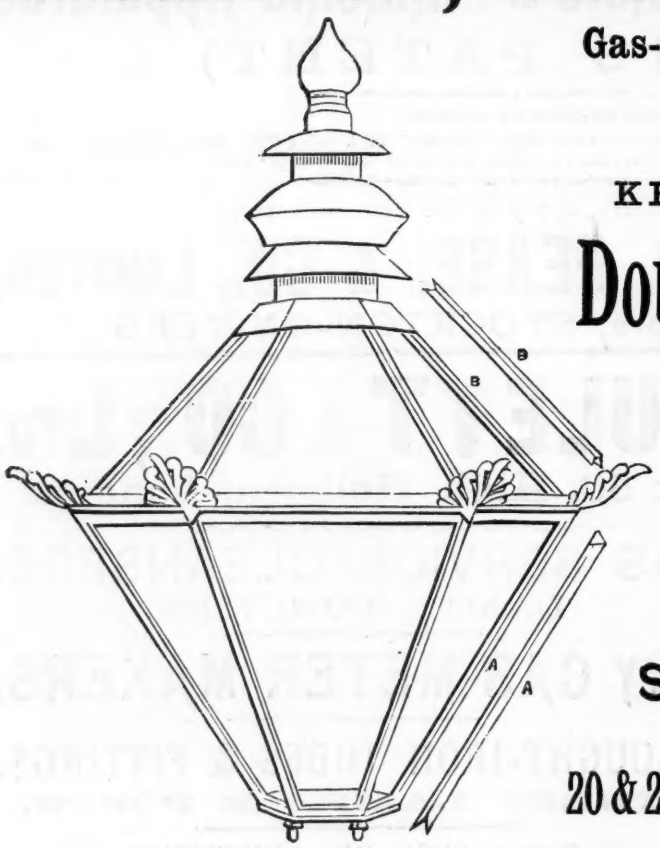

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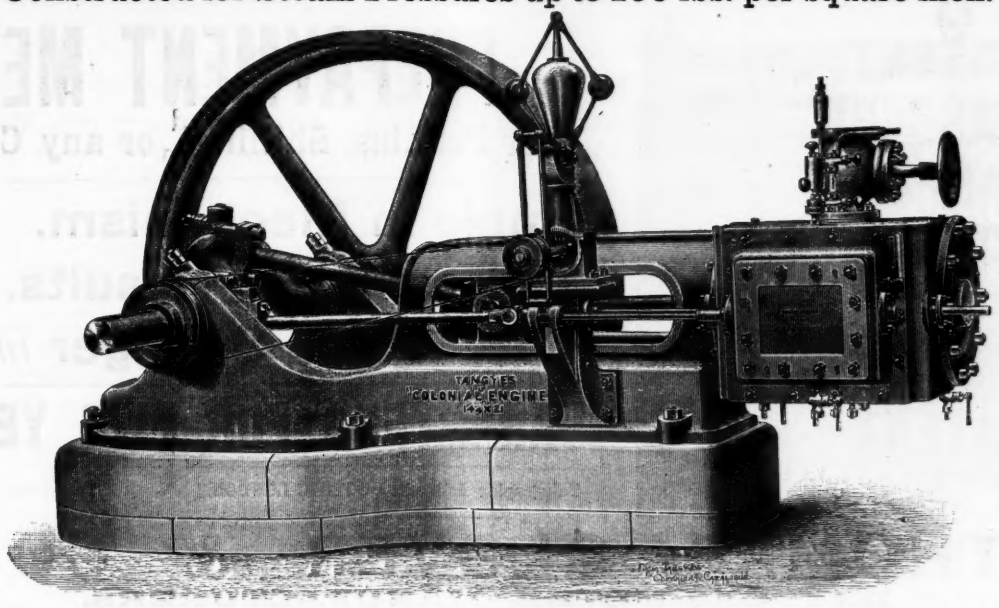

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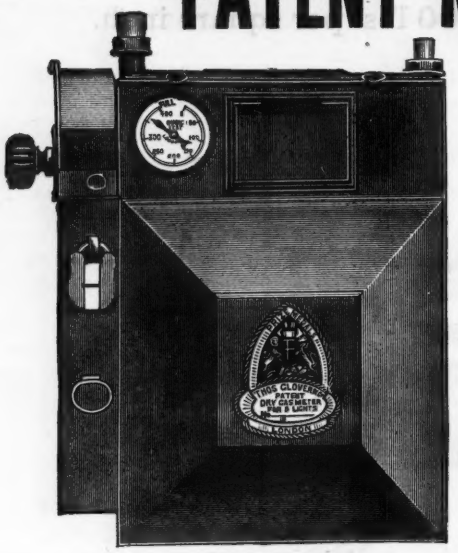

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
"Field's Analysis" for 1895 . . . 1377
The Knell of Gasholder Guide-Framing . . . 1378
The Private Interest of Members of Parliament . . . 1378
A View of British and American Company Finance . . . 1378
Wages in 1894 . . . 1379
WATER AND SANITARY AFFAIRS—
The Progress of the Staines Reservoirs Inquiry . . . 1379
The Meeting of the Chelsea Water Company . . . 1380
THE INCORPORATED GAS INSTITUTE:—
ANNUAL MEETING IN LONDON—
Papers and Discussions (*continued*)—
Discussion on Mr. J. Holliday's Paper . . . 1380
Discussion on Mr. E. H. Stevenson's Paper . . . 1383
Discussion on the Papers by Mr. N. H. Humphrys and Mr. A. Dougall . . . 1385
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 1390
Electric Lighting Memoranda . . . 1390
Presentation to Dr. Auer von Welsbach . . . 1391
The Alkali, &c., Works Act—The Chief Inspector's Report . . . 1391
NOTES:—
Fresh American Oil-Fields . . . 1393
Organic and Combustible Matter . . . 1393
The Conductivity of Boiler Scale . . . 1393
Monazite and Granitic Rocks . . . 1393
COMMUNICATED ARTICLE:—
On the Estimation of Sulphuretted Hydrogen and Carbonic Acid in Gas Liquor. By H. Leicester Greville, F.I.C., F.C.S., &c. . . . 1393
TECHNICAL RECORD:—
German Association of Gas and Water Engineers—Annual Meeting in Berlin . . . 1394
Western (U.S.A.) Gas Association—Annual Meeting at Chattanooga . . . 1395
REGISTER OF PATENTS:—
Water-Meter—Vandeesteen, B. . . . 1396
Incandescent Gas-Burners—Stringfellow, J. H. W. . . . 1396
Mechanism for Automatically Cutting Off Gas—Phipps, T. J. . . . 1396
Generating Acetylene Gas—Exley, J. H. . . . 1397
Gas Motors—Compagnon, A. C., and Guibert, J. . . . 1397
Preventing Bunsen Gas-Stove Burners Lighting-Back—Cannon Hollow-Ware Company, Limited, and Ward, T. . . . 1397
Controlling the Steam Supply to Water-Gas Generators—Cutler, S. 1397
Patent Notices . . . 1398
CORRESPONDENCE:—
Columnless Gasholders . . . 1398
Crossley Gas-Engines—An Explanation . . . 1398
Professor Lewes on the Value of the Sunlight Mantle . . . 1398
Preventing the Freezing of Gasholder Cups . . . 1399
PARLIAMENTARY INTELLIGENCE:—
Progress of Bills . . . 1399
House of Lords Committee—Dublin Corporation Bill . . . 1399
Matlock Bath Gas Bill . . . 1403
House of Commons Committee on the London Water Bills—Staines Reservoirs Bill . . . 1404
LEGAL INTELLIGENCE:—
Supreme Court of Judicature—Court of Appeal—Incandescent Gas-Light Company, Limited, *v.* De Mare Incandescent Gas-Light System, Limited . . . 1408
High Court of Justice—Queen's Bench Division—The Queen *v.* Gibson and Others (Justices) and the Birkdale District Council 1408
The Gas Supply of Birkdale . . . 1409
Claim against the Staffordshire Potteries Water Company . . . 1409
MISCELLANEOUS:—
Edinburgh and Leith Gas Supply—The Annual Accounts . . . 1409
The Gas Coal Contracts of the Glasgow Corporation . . . 1409
Ramsgate Corporation Gas and Water Accounts . . . 1409
Bingley Gas Supply—The Annual Accounts . . . 1410
Tipton Gas Supply . . . 1410
Neath Corporation Gas Supply—A Satisfactory Balance-Sheet . 1410
Sales of Shares . . . 1411
Meeting of the Malta and Mediterranean Gas Company, Limited 1411
Meeting of the Chelsea Water-Works Company . . . 1412
A Defence of Gas . . . 1412
Electric Lighting Notes . . . 1413
Notes from Scotland . . . 1414
Current Sales of Gas Products . . . 1416
Coal Trade Reports . . . 1416
Gas and Water Companies' Stock and Share List . . . 1414
PARAGRAPHS:—
OBITUARY: Mr. G. Lampard; Mr. F. J. Carter; Mr. J. Mackenzie 1380
PERSONAL: Mr. John Bond; Mr. T. B. Jones; Mr. Charles Meiklejohn's Marriage . . . 1380
The Purification of River Water—Differential Charges for Gas . 1390
Powdered Coal for Firing Steam-Boilers . . . 1391
The Proposed Research Laboratory at the Royal Institution . . 1392
Proposed Water Commission for Cincinnati . . . 1396
Leeds Gas Workers and Pipe-Laying Contracts—The Farnborough Gas Company and the Aldershot Gas and Water Bill—Exeter Corporation Water Finances—Mossley Corporation Gas Accounts—Ashton and District Joint Water-Works Committee . . . 1399
Fatal Accident at the Huddersfield Gas-Works . . . 1409
Bursting of a Water-Main in the Camden Road . . . 1411
The Public Lighting of Paignton—Gas *v.* Electric Lighting at Wimbledon . . . 1413
Exhibitions of Gas Appliances—Colwyn Bay and Conway Joint Water Board—Burslem Corporation Gas Department—Reduction in the Price of Gas at Heywood—Gas Lighting at Swanscombe—Hot Water Supply from Gas-Lamp Posts—Gas for Public Lighting at St. Mary Church—Bicester Water Supply . 1417

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EDITORIAL NOTES.

"Field's Analysis" for 1895.

THE new "Field's Analysis," for the year 1895, has been recently issued, and will very soon find its way into the hands of as many of our readers as desire to be possessed of the information it contains—information, as everybody knows, more precise and detailed of its kind than is to be had from any other source. The title-page of the new issue informs us that this is the twenty-seventh year of publication; and we can only say in respect of this statement that the book grows more indispensable, if the term may be permitted, with age. It is of much more general interest now than it was in the old days, when all the subject-matter was taken from Metropolitan examples, inasmuch as it gives the statistically-minded student both a bird's-eye and a microscopic view of a good many typical gas undertakings in London and all parts of the kingdom. It may seem superfluous, to the instructed reader, that we should say all this now about so familiar a guide to gas supply finance as "Field's Analysis." But, strange as it may appear, there are yet probably not a few people interested in the gas industry who are not so much as aware of its existence. Many of the comparative data obtainable in collective form from the "Analysis" have already been noticed in these columns while commenting on the affairs of different Gas Companies and Corporation Gas Committees. In view of what has transpired from time to time with reference to the expenditure of capital and the exigencies of the London Companies, it may be noted that The Gaslight and Coke Company can yet raise £450,000 of stock, and £225,000 of loan capital, making a total of £675,000 between the Administration and a fresh application to Parliament. The Commercial Company have £115,000 of 7 per cent., and £135,000 of loan capital still unraised. These tables apparently do not include any reference to temporary loans from bankers, used as working capital, the existence of which in certain concerns would not be suspected from the figures given. If this borrowing of money on cash account to supplement the regular capital is to be regarded as a permanent feature of the economical working of a gas undertaking, ought it not to appear in the "Analysis"?

The carbonizing data of the London and some other undertakings are affected more and more by the use, in different examples, of fluid carburettors and water gas. The sale of gas per ton by none of the London Companies stands out particularly well as an indication of good carbonizing. Whatever distinction may have been made years ago between the carbonizing practices of the South Metropolitan and the other London Companies, has practically disappeared, so far as the figures here given are evidence. The Gaslight and Coke Company sell 9556 cubic feet per ton; the South Metropolitan come next with 9341 cubic feet; and the Commercial sell 9215 cubic feet per ton. One hears occasionally, from technical papers and discussions, of high carbonizing returns being common in some places; but most of the undertakings included in these tables are modest in this regard. Those undertakings where upwards of 10,000 cubic feet per ton are actually sold to the consumers can be counted on the fingers of one hand. In the whole Metropolitan and Suburban district, there is only one example of this kind—Richmond; and the highest of all is Carlisle, with a sale of 10,217 cubic feet per ton, of 19·36-candle gas. The coke returns would be much more valuable if the weight and proportion sold were given. The working out of estimated quantities of coke to two places of decimals of hundredweights per ton of coal is more symmetrical than convincing.

The differences are very marked in the comparative cost of coal to the different undertakings, less residuals. The Commercial cost per ton is 4s. 7·08d.; the Chartered, 3s. 11·88d.; and the South Metropolitan, 2s. 9·03d.—all, of course, selling the same quality of gas. Some of the differences under this head in the case of the Suburban Companies are traceable to local conditions. Wages, again, are about 1s. per ton less under South Metropolitan management than with either of the other London Companies; and in the suburbs, Brentford, with inclined retorts, is jostled at the bottom of the list by Richmond, using West's hand-power stoking machinery.

We cannot find space for going through all the instructive

disclosures of the "Analysis" with reference to the Provincial undertakings, upon which more than one article might easily be written. Caution would need to be exercised, moreover, to make allowance for the different periods covered by the accounts of the various Companies and Corporations analyzed. It is stated on the title-page that the accounts of the Provincial undertakings are "for "the year ending *in* 1895." It appears, however, that in the case of Birmingham the account year is that ending on March 31 last (reported by us so lately as the 19th ult.); so that the figures in this important example apply to a different year altogether from that embraced in the other municipal returns. With regard to the Companies, also, some accounts end in June, and others in December. But no notice of these discrepancies is given by the compiler. Hence the value of the figures contained in the analysis relating to certain matters—as the returns (say) from sulphate of ammonia on a falling market—is to be questioned. We observe, by the way, that Preston has been given up as a "bad job," after standing opposite a white line for several years. Rochester has been promoted to the vacant place, although it cannot be regarded as an equivalent. Rightly or wrongly, however, the Preston Company considered themselves prejudiced at their last appearance in Parliament by certain figures published in the older "Analyses;" and hence they decided to have nothing more to do with the publication. Probably it was the improper use of the figures that gave the Preston Company such trouble, because no real harm can accrue to a well-managed statutory gas undertaking from the mere presentment, in a particular form, of information respecting its working which has already been duly published.

The Knell of Gasholder Guide-Framing.

THE papers read at The Gas Institute meeting vary considerably in merit, as is usually the case with collections of technical literature. But while some of them are interesting and valuable in themselves, others were useful in provoking most instructive discussions. In the former category, the first place indubitably belongs to Mr. E. Lloyd Pease's paper on the further development of the author's wire-rope system of gasholder guiding, which, as the President remarked, is one of the most original innovations in gas engineering that has been introduced into the industry within living experience. It is of the greatest importance, that when novelties, whether promising or the reverse, have been brought forward at the meetings of technical societies, their after-course should be fully and fairly followed up; yet nothing is rarer than satisfactory action upon these lines. The first thing an inventor seeks is a fit audience to whom he can impart his plans and proposals; but when fate and circumstances have proved either too favourable or too unkind, it is difficult to secure a record, first hand, of the later facts of the case. This, by the way, should be one of the points for Presidents seeking matter for their addresses to look after. When novelties succeed, it is good for the student to be informed of the why and the wherefore of their success; and there are even more valuable lessons to be learnt from reliable records of failures.

If Mr. Pease's paper means anything at all, it means that the days of fixed lofty guide-framing for gasholders, after the familiar pattern, are numbered. It is not to be expected, of course, that all examples of such guide-framing will forthwith be done away with throughout the land. For a generation at least there will be those engineers and managers who will have nothing to do with the new-fangled idea—not for any valid reason that they can adduce against it, but simply because they cannot bring themselves to like it. It is as clear as daylight, however, that when the first gasholder went up and down without standing guides, the doom of the old-fashioned system was sealed. Considerations of extreme size and weight on the one end of the scale, and of the insignificance of the saving to be secured by change of design at the other, will operate to confine the application of rope guiding to middle-sized examples; but these are the great majority. There can be no defence in the old order of design against the claim of the newer to superior economy of material, money, and time; and, as regards safety, the fact that, of all the gasholders in a region struck by a tornado, the only one that stood was rope-guided, is a strong confirmation of an experience that is already large, and is widening every season. A meed of praise should not be withheld from those Engineers in charge of gas-works, ranging in capacity from Sligo to Middlesbrough, and Nottingham or Manchester, who have been open-minded enough to afford the necessary facility for the demonstration of the rectitude of the principles upon which Mr. Pease has relied; for without this aid, the experimental triumph of these principles would have been indefinitely delayed.

The Private Interest of Members of Parliament.

THE Select Committee of the House of Commons which is engaged on the inquiry as to whether it is desirable to define more precisely the nature and extent of personal pecuniary interest in any question before the House which would disable a member from voting upon such question, and what procedure can be most advantageously adopted for enforcing such disability, sat again last Wednesday, for the purpose of taking the evidence of Lord Peel, the ex-Speaker. This was even more interesting than that of Mr. Speaker Gully, because Lord Peel, whose tenure of the Chair was of eleven years' duration, had personal knowledge of several precedents illustrating the bearings of the questions before the Committee. He gave an account of what happened in 1884, when a question of personal interest arose in connection with a Metropolitan Water Bill, upon Mr. Coope claiming to vote in his capacity of member for a county materially affected by the measure at that time before the House, irrespective of his position as Director of a London Water Company. On this occasion, it was urged in the House that if Mr. Coope had a considerable number of shares in the Company, which was assumed to be the case, and if those shares would be depreciated in value by the passing of the Bill, then it would follow that the honourable member had a most direct and large pecuniary interest in the question. Sir S. Northcote thought this argument, if pressed, would go much too far, and would be too wide for the occasion, as implying that anybody who was a shareholder or was in any way interested in water companies would be precluded from voting. On a division, Mr. Coope's vote was allowed by a very large majority. Lord Peel also stated that prior to 1837 there were disallowances of the votes of members on Private Bills; but since that time these "appear to have been almost discontinued." He would not admit, however, that this change was due to a growing distinction between the position of a shareholder and that of a director. Lord Peel agreed with the present Speaker in his statement of the law bearing on this matter, and also in the contention that it would be highly undesirable to establish a more definite general rule. He further told the Committee that, as Speaker, he had been frequently consulted by members privately as to what they ought to do; and he had always advised against their voting if there was any doubt on the point. There does not appear to be any better way than this of dealing with such a difficult and delicate matter, whether in Parliament or elsewhere.

A View of British and American Company Finance.

A REMARKABLE testimony to the value of the British system of statutory control of such important national concerns as railways, gas and water supply, and the like, is furnished by a writer in the current number of the "Engineering Magazine." The particular subject of the article in question is bluntly entitled "The Fruits of "Fraudulent Railroad Management," as presented in the United States. But one of the causes of the deplorable state of things described by the writer is the blindness of American publicists to the failure of commercial competition as a means of securing efficiency in public services of the nature of those taken for his text. The author was moved to formulate his criticism by certain particulars recently given in the "Statist" as to last year's working of three groups of British companies representing as many different kinds of industries—one being that of gas supply. Upon this class of undertakings, the average dividend paid was shown to be 8 per cent.; and the American critic is thereupon stirred up to lament over what his countrymen have lost, and are losing, by their own unfortunate methods of company administration. "In our "Union Pacific, Northern Pacific, Reading, Atchison, and "Erie railways, and in our Cordage and other industrial "companies of similar stamp, hundreds of millions of "dollars have been lost; and at the present moment there

"are not less than two hundred important railways and "other large corporations in the hands of receivers. The "result is widespread distrust at home and such utter "discredit abroad that, while British Consols stand at 113, "and the Bank of England rate is 2 per cent., and while "3 per cent. municipal stocks are being applied for ten "times over, and sold at a premium, the investors of Great "Britain will not touch our securities at any price." The writer proceeds to lay the whole blame for this state of things upon dishonest company management, which he stigmatizes in terms too strong to be repeated here. As a matter of fact, it is probably due rather to the antecedent weakness already mentioned, which, by depriving public service undertakings of statutory protection and control, has forced upon the most legitimate enterprise many of the methods more appropriate to piracy. Among other reforms, the critic proposes that the United States should initiate legislation on the lines of the British Companies' Acts. It would be very desirable, in the interest of the United States, that something should be done to restore confidence in the national and industrial finance of one of the wealthiest and most enterprising regions of the earth. But it is much to be feared that the power of initiative of movement to this intent does not at present exist among the people. We obtained our statutes for the regulation and protection of such industries as cannot safely exist and develop without this support, from Parliaments which recognized the rule that it is the function of Governments to govern in the interest of the community at large. Whether we could get such laws as these enacted now-a-days is almost doubtful. The democracy has many virtues; but a wise perception of the right and safe course in matters of finance, national or industrial, is not one of them. Happily, the broad lines of British financial practice have been laid down by Governments that did understand these matters; and of this wisdom the country is not likely to sacrifice the benefits at the bidding of Progressive politicians. It is difficult, to the verge of impossibility, to see where in the United States any similar legislation is to come from. Individually, the average American is a smart business man. But he is absolutely dark as to the expediency of adjusting the powers and privileges of industrial corporations, first, to the ascertained requirements of the public, and, secondly, to the conditions which govern their own stability and efficiency. So the ignorance and apathy of the general public are responsible in the long run for the indifference of legislators and the misdemeanour of company officials. It is to be feared that company administration in England is not all the fancy of the magazine critic paints it. Our Company laws, both for statutory and limited undertakings, need improvement; but they are little likely to get it in the existing condition of the parliamentary system, which appears to be degenerating into legislative impotence.

Wages in 1894.

The second annual Board of Trade report on changes in wages and in hours of labour in the United Kingdom, in 1894, forms an addition to the existing mass of statistical information on this subject. The year is classified as one of trade revival, following a period of general depression; but it was nevertheless accompanied by a fall in the amount of wages paid for a full week's work in many industries—miners and quarrymen being the chief sufferers. There was also some loss of wages in the metal, engineering, and shipbuilding trades, as well as in miscellaneous trades not separately enumerated. The employees of public bodies have been exceptionally well off, as practically the whole of them rank as having received higher wages. This improvement has been accompanied by a gradual, but general, shortening of the hours of labour. During the present year, the tendency of change has so far been favourable to the workers; but the rate of increase in wages has been somewhat less than it was in either of the two previous years. As regards Government employment, by far the most important change recorded last year was the introduction of the average eight-hour day in the various departments of the public service. In some reported cases of alleged increase of wages, examples are given of the working of economic laws which labour agitators are apt to ignore. Two significant instances illustrate the actual results of apparently successful strikes. As the direct result of a local strike among cotton weavers, an advance was granted varying from 2½ to 5 per cent. for certain classes of work; and this was claimed as a rise of wages. In point of fact, the employers who had granted it discontinued working the particular class of goods for which the wages had been raised; so that the real result of the strike was a net reduction of wages paid and taken. Again, in the boot and shoe trade, there was an advance of from 10 to 40 per cent. granted in a certain factory upon the piece rates for various classes of work, with the eventual result that the employers did away with piecework, introduced lasting and finishing machinery, and paid the men weekly wages for the work they still had to do. One would think the lesson would be obvious; but the proverbial saying, which must have been made in anticipation for Socialists, assures us that "there are none "so blind as those who won't see."

WATER AND SANITARY AFFAIRS.

The Hybrid Committee of the House of Commons, presided over by Sir J. Pease, occupied two days last week in the further consideration of the Staines Reservoirs Bill. Evidence in opposition to the scheme was concluded on Tuesday; and Mr. Balfour Browne proceeded to address the Committee on behalf of the London County Council—contending that the object of the Bill was really to forestall the decision of the Water Board about to be established, as also to put out of court a scheme for bringing water from Wales. The learned Counsel seems a little astray in his dates, for assuredly the Staines scheme was on foot before there was any Bill for the formation of a Water Board. In respect to the Welsh project, for which there is no Bill at present, London cannot wait for its elaboration. Something must needs be done prior to the day when water will flow into London from the head waters of the Wye. Mr. Balfour Browne went on to entertain the Committee with the notion which had been put forward by his witnesses, that the three Companies concerned in the Bill had plenty of water at command. Making use of their own figures, the learned Counsel undertook to show that the Companies, when asserting that there was a pressing emergency, "were not to be believed." We apprehend that the Companies understand their figures perfectly well, and are not likely to seek permission to put themselves to an unnecessary expense. Following the address from Mr. Balfour Browne, an objection was urged on behalf of the Corporation of the City, that the works contemplated by the promoters of the Bill would reduce the scour of the lower river, and throw new and heavy charges on the Port Sanitary Authority for scavenging. But experience has tended to show that the scour of the river of late years has been rather more than was desirable. Apart from this consideration, there is the fact that an ample flow is to be maintained over Teddington Weir, whatever may be previously diverted into the Staines reservoirs. It has also been shown in Mr. Middleton's evidence that, as additional supplies are absolutely necesssary for the West Middlesex and Grand Junction Companies, so, unless increased storage is provided for, the amount of water required to be taken from the Thames would be such as to reduce the quantity flowing over Teddington Weir to less than 200 million gallons per day. Such a reduction, according to the opinion of the Thames Conservancy Board and other authorities, would be fraught with evil consequences. The Staines reservoirs, therefore, would tend to preserve the river, by securing an adequate flow at all times. The Port Sanitary Authority may accordingly rest content with the Bill as a friendly measure. A point of peculiar importance relates to the suggestion from the opponents of the scheme that, in order to meet any cases of emergency which might arise, it would be sufficient to give the Companies power to increase their present intake. Mr. Pope, in replying on the whole case on behalf of the promoters, has contended that the Committee could not so amend the Bill as to grant this power—notice not having been given to the riparian owners. The Bill in its present form is certainly preferable, as conserving the river, for which the opposition claim to have so much regard. At the close of the sitting on Wednesday, the Chairman stated that the Committee would endeavour to come to a decision on the Staines Reservoirs Bill on the ensuing Friday, taking up the New River Bill on Tuesday (to-day), when they would

be able to give their decision on the Staines Bill. The Committee met on Friday; but the sitting was private.

The Chelsea Water Company may be congratulated on the prosperity which they are enjoying, and the peaceful prospect which appears to lie before them. At their half-yearly meeting last week, presided over by the Governor (Sir W. H. Wyatt), the progress which had then been made in getting the Company's Private Bill through Parliament was mentioned with satisfaction. Having fought the Bill in the Commons, without effecting any material change in its provisions, the London County Council have allowed it to proceed unopposed in the House of Lords. At the instance of the Local Government Board, a sinking fund clause was introduced by the Hybrid Committee in the Commons, in addition to which a restriction was laid upon the use of the intake at Thames Ditton; the Local Government Board having the regulating power. That the intake can be used in case of emergency, and without any trouble with the County Council, is sufficient to meet the requirements of the Company. That the £50,000 to be raised under the powers of the Bill should only be applied to the carrying out of the works authorized by that measure, is most carefully stipulated, but is only a reasonable provision. The Committee, in their report to the House, stated that they had not conferred additional powers on the Company, except such as were shown to be necessary in the interests of the public. The Company asked for nothing more; and the project which they brought forward has thus been fully approved by Parliament. It is only to be regretted that, for reasons which we suppose must be called constitutional, the Bill had to be held over from one session to another, thus causing the loss of a year. The hope of the Directors of the Chelsea Company is that there will now be some cessation in the attacks which emanate from the County Council, and which are directed against the Metropolitan Water Companies in general. Perhaps the day is not far off when the London County Council will have to stand on the defensive, and will have less time or inclination for indulging in an aggressive policy.

OBITUARY.

Mr. G. Lampard, of Hollingbourne, died recently, at the age of 66, after a few days' illness. Deceased was for many years Secretary of the Hollingbourne Gas Company.

Mr. F. J. Carter, the Secretary of the Dunmow Gas Company, died somewhat suddenly on the 6th inst., at the early age of 35, from an affection of the heart, for which he was under treatment.

Mr. J. Mackenzie, the Manager of the Wilmslow and Alderley Edge Gas Company, died last Wednesday. As many of our readers will remember, Mr. Mackenzie attended the meeting of the Gas Institute; but shortly after his return home he was seized with the serious illness to which he succumbed. Deceased had occupied his position at Wilmslow for 23 years, and was a well-known member of the Manchester District Institution, of which he was one of the Auditors.

PERSONAL.

Mr. John Bond, an assistant at the Salford Corporation Gas-Works, has been selected by the Gas Committee of the Leeds Corporation for the position of Manager of their New Wortley works. There were 36 candidates for the post.

Mr. T. B. Jones, the Manager of the Repton Gas-Works, has received the appointment of Manager of the Dronfield Gas Company; and he will enter upon his duties on the 13th prox. Before going to Repton, Mr. Jones was for a considerable time at Willenhall, where he made a number of friends.

The marriage of Mr. Charles Meiklejohn, the Engineer of the Rugby Gas Company, and Miss Minnie Mary Watson, daughter of Mr. and Mrs. Joseph Watson, of St. Helens, Fellows Road, South Hampstead, was solemnized at St. Saviour's Church in that neighbourhood, on Thursday last. Much local interest was manifested in the ceremony. A reception of friends was afterwards held at the house of the bride's father, where were displayed the presents from the admirers and well-wishers of the happy pair. They were both numerous and costly—among them being the silver tea and coffee service recently presented to Mr. Meiklejohn by the members of the Midland Association of Gas Managers (of which he is the popular Honorary Secretary), and other tokens of the esteem in which he is held in the gas industry. Later in the day, the bride and bridegroom left for a tour in Scotland. In wishing them all felicity for their future, we are sure that we are also giving expression to the sentiments of a large circle of our readers.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-THIRD ANNUAL GENERAL MEETING,

HELD AT THE

SOCIETY OF ARTS, LONDON, June 9, 10, 11, 1896.

W. R. Chester, Esq., M.Inst.C.E., President.

Discussion on Mr. Holliday's Paper on "Gas-Engines as Economical Motors."

[See *ante*, p. 1327.]

The President, in opening the discussion, thought it was a matter for congratulation that a young member of the Institute had come forward with so excellent a paper.

Mr. W. Carr (Stalybridge) said he had for a long time taken an interest in gas-engines; and he believed, like Mr. Holliday, that there was much to be done for the future extension of the consumption of gas by their introduction. He thoroughly endorsed what the author had said with regard to the economical effect of gas-engines in cases where intermittent or small power was required. Wherever work was not regular and continuous, gas-engines had a very good chance of beating even the best steam-engines—certainly any small steam-engines—with gas at a reasonable price. The author, after giving a table—which he (Mr. Carr) regretted was not read in full—showing the extent to which gas-engines were used in Scarborough, said it was of course practically impossible to institute any fair comparison of cost between steam or other prime movers necessary to generate the particular power set forth in the table. He thought it was hardly fair to such men as the late Mr. Denny Lane and others who had made gas-engines a special study, and had given careful calculations as to the cost of the development of power from various motors, to make this statement. It was quite possible to do it with a fair amount of accuracy; and, indeed, the author went on, in another part of the paper, to demonstrate why the cost of a gas motor was far less than it was for hydraulic, steam, or other motors for small powers. The difficulty they had laboured under for many years after the first introduction of the Otto gas-engine, was the high price at which it was produced. The patentees had a very good thing in their hands, and they made a very good thing out of it. But to a great extent this prevented the sellers of gas from getting that advantage from the motor which had accrued since the patent rights had run out. Now that any makers could adopt this system, a great many more engines were brought into use in the same period. He had been away from England for some time, and had, to a great extent, lost grip of this matter; but, upon his return, even cursory observation showed that the use of gas-engines was extending very widely, and that the manufacturers of them were greatly enlarging their premises and businesses. It was quite evident that these people had only to exert themselves to a small extent to enable them to increase their trade by the introduction of this form of power, which stood first for anything small and intermittent, though, of course, it could never hope to compete in large manufacturing industries, where thousands of horse power were required, except in cases where the transmission of power entailed great loss. Where the engines were of modern design, and they had the power in the centre, and the transmission was not too costly, steam power would, of course, beat the gas-engine; but this was the only condition in which it had an advantage. Even in old-fashioned works, where the power was transmitted some hundreds of yards through shafting, gas-engines could supply the power more cheaply, if they were put near the works, and kept on the several floors where the work was required, than even large compound steam-engines. He hoped Mr. Holliday would continue his researches, and at some future meeting furnish still more definite data. What he had done already ought to give a stimulus to gas engineers to pay more attention to this branch of their business.

Mr. T. Glover (West Bromwich) said one very interesting feature of the paper was the reference to the use of gas-engines for the generation of power for electric purposes. Referring to the table showing the results of driving dynamos by gas-engines, he should like to know why

the amount of gas required was so high per horse power in some cases. He thought it possibly might be due to the engines running under load, because he found that the gas used in June was 39·5 cubic feet per horse power, which was the highest; whereas it was lowest in the winter time. In June, the engines would no doubt be running under load for a considerable time. He would also ask whether the gas used was per indicated horse power or per electric horse power. He should also be glad if they could gather any information as to whether it was possible to obviate the fluctuations in the light which were sometimes experienced when gas-engines were used for generating electricity. It seemed to him that a gas-engine was a very imperfect motor so long as it only obtained the gas at every second stroke—power being generated intermittently, and the momentum stored up in the fly-wheel; and he thought the engines would always be defective on this account for electric lighting purposes until they got power at every stroke.

Mr. H. Tobey (Malton) said Mr. Holliday had raised the question of charging differential rates in favour of the using of gas for motive power; and he seemed to throw some doubt on the advisability of doing this. For his own part, he was much in favour of it, because it tended to induce the users of power to put down gas-engines, when otherwise they would not do so. Gas companies could afford to make a differential rate in such cases, because the consumption was pretty uniform all the year round, and was a day consumption. He found himself that giving such rates did induce people to put down engines. Some fifteen years ago, his Directors reduced the rate for gas-engines 25 per cent.; and at the present time the consumption of gas for motive power was about 4 per cent. of the total, as against Mr. Holliday's 2½ per cent. Malton was a purely agricultural town, so that it was as badly off with regard to manufactories as Scarborough. It was also stated that it was not possible for companies working on the sliding-scale to charge differential rates; but they were so working at Malton, and did it.

Alderman Miles (Bolton) said the subject before the meeting was interesting at all times. He thought all were practically of one opinion that for small motors, and where intermittent power was required, nothing could compete with a gas-engine. Unfortunately, his experience, while being satisfactory on this head, was not altogether so with regard to larger engines. At Bolton there were about 120 gas-engines ranging from ½-horse to 20-horse power. Two of the latter were introduced in a large printing establishment; and naturally, considering that the engines were working regularly twelve hours a day, and sometimes more, they found their gas account very large—in fact, so large that the proprietors applied for some reduction by way of a differential rate, or something of the kind. With regard to charging a differential rate, either for gas-engines or for cooking-stoves, he was not at all in favour of it, and did not think that it was the right system. It was easy enough to reduce the price of gas, and to get more consumption; but it did not appear to him to be just to the ordinary gas consumers, who had built up the prosperity of the undertaking and made it successful, while gas-engines and cooking-stoves had only come into operation comparatively recently. If the price were reduced for power and cooking, obviously it must be kept up to the ordinary consumers longer than it otherwise would be. At Bolton, they could not see their way to reduce the rate in the case he referred to; and unfortunately they lost good customers in consequence.

Mr. J. C. Belton (Willenhall) said, with regard to a differential price, he endorsed the remarks of Alderman Miles. He thought it was an injustice to the ordinary consumer to make a differential rate for special purposes. Their object should be to reduce the price of gas all round, and introduce a sliding-scale in proportion to the consumption, rather than make reductions for certain purposes. Undoubtedly, the introduction of gas-engines had been a great advantage to the industry; and they ought to encourage their use, because it had a tendency to make the consumption more equal. In his works, he found that frequently the day and night consumption was actually equalized; and he could only attribute this to the consumption of gas for motive power, which amounted approximately to 20 per cent. of the gas sold. As to the economy of the gas-engine, that was now beyond dispute, not merely for small motors, but for large works. In Willenhall, they had engines of from 2 to 30 horse power. Only lately, two large steam-engines had been turned out, and 25 and 30 horse power gas-engines introduced to do their work; and they were giving every satisfaction on the score of economy. He did not see any force in the remark that gas-engines were only economical for intermittent use, seeing that they were in use in his town in factories working full time every day; and he did not think people would adopt them there if they were not economical.

Mr. H. Lees (Hexham) said he could not quite concur in Alderman Miles's statement as to their being agreed all over the country on the advantages of gas-engines as small motors; or, if they were agreed, they did not carry out their convictions. How many gas-works were there where they would find gas-engines in use? But if they were useful as small motors to the general public, how much more so might they be in gas-works, where they had their gas at cost price. The value of gas-engines in manufactories of various kinds was largely owing to the power of concentration on some particular section of the works. For instance, in the works of Sir William Armstrong, a large number of gas-engines were employed; and they found them very useful, because they could distribute their engines in different parts of the establishment, and while one part was standing, the other might be kept at work. They thus became very good customers of the Newcastle Gas Company. There had certainly been a great increase in the consumption of gas for motive power; and gas-engine makers were busier than ever. He knew of one who was working night and day, and no doubt this was brought about very largely by the reduction in the cost of the engines. But there was still room for further improvement in this direction. Whatever difficulty there might have been at one time from the price of gas, doubtless the great drawback was the cost of the engine. But since this had been brought more nearly to the cost of steam-engines, there had been a considerable development. There was a great deal to be said in favour of Alderman Miles's argument against making a difference between one consumer and another. Any allowance that was made with regard to consumers of gas for motive power should be based on the advantage they gained from the fact that they used gas largely in the daytime; and, after all, this advantage did not amount to a great deal. He had had occasion recently to deal with the question of extending their mains for a gas-engine. The intending consumer told him that it would not cost him any more for gas than he had already been paying for labour; and he was going to have the gas at 3s. 4d. per 1000 cubic feet. If this were the case with a 12-horse power gas-engine, there was evidently a great field for extension in this direction.

Mr. W. W. Hutchinson (Barnsley) said he thought that the most valuable suggestion in the paper was one at its close, with regard to the hiring of gas-engines on the same lines as cooking-stoves, &c. He came from a town which was not noted for extremely cheap gas; and he thought there must be a great deal in favour of gas-engines (looked at from a user's point of view) when he found that they had about 55 in a place like Barnsley, whereas there were only 120 in Bolton. With regard to differential rates, he disagreed entirely with the reasoning of Alderman Miles. They had this year adopted the system of extending the minimum rate—viz., 2s. 10d., less 5 per cent.—to gas-engines; and he expected it would lead to their further employment for powers ranging from ½ horse up to 20 horse, which were about the types used there. But if they could see their way to follow out this recommendation of hiring-out gas-engines, he had no doubt it would expedite matters materially; and for this reason: There were multitudes of small steam-engines scattered up and down the country, of a fairly useful character, even if second-hand, which could be had almost for an old song; and these came very nearly into competition with gas-engines, on account of the small first outlay to tradesmen of limited means. No doubt the price of gas-engines had been greatly reduced, and they were much more easy of attainment than formerly by people with small capital. But if gas companies could carry out the idea of letting them on hire, he was sure it would lead to good results. He thought that users of gas for power were entitled to consideration in the shape of reduced price, because they took the gas in the daytime, when the

ordinary consumers did not, and thus enabled the suppliers to reduce the charge to all.

Mr. D. Bruce Peebles (Edinburgh) said that for some years past he had paid a good deal of attention to the construction and manufacture of gas-engines; and about fourteen months ago he put out a steam-engine and put in a gas-engine of 20-horse power. He was pleased to say that a few days previously, in making a comparison of the cost of working, he found the gas-engine gave a considerable sum on the credit side. No doubt, as time went on, they would see gas-engines manufactured in every town, just as they had steam-engine manufacturers all over the country; and he believed this would be one of the mainstays of the gas industry.

Mr. T. Bower (West Hartlepool) said that they allowed 15 per cent. off to users of gas for motive power; bringing the net price down to about 2s. per 1000 cubic feet. As soon as this course was adopted, they had found it a decided advantage, more particularly in respect of small engines of 2 to 10 horse power. They had, however, much larger engines than this. One, at a wire-rope manufactory, was of 80-horse power nominal—a single-cylinder engine—which he believed was about the largest ever made at the time it was constructed. The users were perfectly satisfied; and at present they had no desire whatever to go back to steam, notwithstanding the fact that West Hartlepool was renowned for the best type of marine engines. The dream of most modern engineers was that they should get down the duty to 1 lb. of coal per horse power; and although this had not yet been quite accomplished, a set of quadruple engines had been recently tested which approached very nearly to this point. When they had such ideal steam-engines at command, it necessarily followed that gas-engines had to meet keener competition than in many places. But, on the other hand, there were many steam-engines which consumed as high as 17 or 18 lbs. of coal per indicated horse-power per hour; and with such engines gas had an easy victory. There could be no doubt that, in any case where over 4 or 5 lbs. of coal per horse power were used, a gas-engine, with gas at 2s. 6d. per 1000 cubic feet, could compete satisfactorily. He was not at all in accord with Alderman Miles, that they ought not to give advantages to users of gas for motive power. They must remember the fact that most of these users were also consumers of gas for lighting purposes; and it was to their advantage, and to that of the companies, that they should have such a discount as would encourage gas to be used in place of steam. He had been advocating the use of gas-engines for several years; and they had now engines of a large type used in their shipyards. But he much regretted that, within the last three months, one of 12-horse and one of 16-horse power had been displaced by electric motors. He was not in a position to give details as to what the cost of working by this system would be, as it was yet too soon. Their member of Parliament—Mr. Thomas Richardson—who was at present Chairman of the North-East Coast Association of Shipbuilding Engineers, was a great advocate for this form of power; and it had now been introduced into two or three works. Very shortly they would be able to obtain the result. Another element in favour of gas-engines was that it removed the difficulty which often arose in dealing with men during labour disputes. It was always an advantage, instead of having to go to the Engineman's Association to get permission for him to go on two or three hours extra when there was a press of work, to be able to put on an unskilled labourer to run a gas-engine. Such difficulties as this had occurred in his town, and had no doubt greatly assisted in the introduction of a larger type of gas-engines in the Hartlepools. They also had engines in use for many smaller purposes—among them the production of electric light for tradesmen. They had found it desirable to allow a discount; and, if he could induce his Directors to agree to it, he should before long recommend them to make a still further allowance.

Mr. T. Travers (Cork) said in his city they not only let out gas-engines on hire, but also charged a differential rate, with the most satisfactory results. They had even gone a step beyond this. Mr. Glover was afraid that a gas-engine would not work electric light machinery steadily; but they were using them for electric lighting purposes in several places in Cork, where they were giving a very steady light. The Corporation a short time ago obtained a Provisional Order to supply electric light at 6d. per unit; but the Gas Company ascertained the actual cost of working the electric light, and found it was much less than 2d. per unit. The next step they took, therefore, was to advertise, at an exhibition which was recently held, that they were prepared not only to let out gas-engines on the hire system, but combine dynamos with them. They got out some large placards to this effect, and the result was that they took the wind out of the sails of the Town Council to a considerable extent, because they announced that these engines and dynamos would produce electric light at less than 2d. per unit. They had already received several orders for the supply of gas-engines and dynamos.

Mr. J. W. Buckley (Falmouth) remarked that they all admitted the fact that there was a considerable field for the increased consumption of gas for motive power. He should like to ask those who were opposed to a differential rate for this purpose what they would do in cases where the price of gas was prohibitive, comparatively to steam-engines—say, where the price was above 3s. per 1000 cubic feet. This argument would apply more forcibly in the case of small gas-works. In his town, they had two or three consumers who were desirous of working gas-engines; and they said that if they could be supplied with gas at less than 3s. per 1000 cubic feet they would adopt it, but if not they would use Dowson gas. He should like to ask those who opposed a differential rate whether they would have allowed these people to work the motors by Dowson gas or reduced the price? His Directors, after considering the matter, resolved to allow a differential rate by a reduction of 20 per cent., which brought the price down from 3s. 6d. to about 2s. 10d.; and in every case, he was pleased to say, those contemplating working gas-engines had availed themselves of coal gas. Another fact, which did not seem to have been considered, was this: It was said to be unfair to the ordinary gas consumer to allow a differential rate. But it must be remembered that gas for motive power was used during the daytime, and that the ordinary mains were being utilized. They did not require any extra capital outlay, either for mains or for gasholder capacity; and he was strongly of opinion, therefore, that in the case of small works, where the price was more than 3s. per 1000 cubic feet, it would be very advantageous to offer a differential rate.

Mr. D. Irving (Bristol) said he believed that Messrs. Crossley would undertake to supply gas-engines which would work from full load to no load with a speed variation of not more than 3 per cent., or with a full load to half-load within 2 per cent. This was practically steady enough for almost any purpose.

Mr. S. W. Durkin (Southampton) said there were several gas-engines at work in his town for the purpose of electric lighting; and his experience was that the light so obtained kept very steady indeed. The members were much obliged to Mr. Holliday for ventilating this subject, which was becoming more important every day. They had at Southampton about ninety gas-engines at work, varying from about ¼ to 20 horse power, for all sorts of trade purposes. One of the latter size had recently been introduced for printing a daily paper with a "Hoe" machine. Another purpose for which gas power was used was for a refrigerator, in the chamber of which chilled meat brought from America was stored. The South Western Railway Company were, he believed, obliged to keep this chamber down to 28° Fahr., so that in the present tropical weather it proved a good customer. Gas-engines were also used for various mechanical purposes, and were coming more and more into vogue. There was no differential rate at Southampton; the ordinary price being only 2s. 6d. per 1000 cubic feet in the town. There was no doubt that the employment of gas-engines brought a good "day-load" revenue to gas companies, without any great outlay of capital on their part. It had been stated that gas-engines seldom found a place on gas-works. At Southampton they had for many years employed this power for breaking coke, for which purpose they found it very convenient.

Mr. W. Carr asked leave to add a word in explanation of his previous remarks. A subsequent speaker said he did not know why it should be said that gas-engines were only useful where intermittent power was required. That was not at all what he (Mr. Carr) wished to convey, but rather that for intermittent power the gas-engine had no competitor whatever. It was very good for other things; but for intermittent power it had no rival.

Alderman MILES asked if Mr. Holliday or any other gentleman could throw further light on the question of using gas-engines for central station electric lighting. He said that this was a matter in which he felt great interest, inasmuch as, if suitable gas-engines could be found to economically and steadily drive the machinery in central stations for electric lighting, those companies and corporations who possessed both gas and electric lighting plants would be mutually benefited.

The PRESIDENT having explained that Mr. Holliday had, at his suggestion, omitted, for the purpose of saving time, reading the table to which Mr. Carr had referred, said the discussion had been an exceedingly interesting one. It had resolved itself very largely into the question of how far it was desirable to have differential prices. He agreed very much with Alderman Miles, that no one particular trade had any right to have a preferential price of gas over another. But it was an entirely different matter when it came to be a question between large and small consumers. The large consumer took his gas without necessitating the same expenditure in the examination of the meter, in the laying of service-pipes and connections, and in a variety of other ways; and therefore he was entitled, in justice, to have his gas at a somewhat lower price corresponding to the diminished cost to the suppliers. It might be interesting to allude once more—as Mr. Travers had emphasized the matter—to the application of gas for providing electric light, to which he had referred in his address. Cork seemed to have led the way, in this particular instance, with regard to hiring dynamos and engines. But there could be no question that, in private installations, electric lighting would cost less than 2d. per unit, as compared with 5d. or 6d., which was the customary price for a town supply. In the instance referred to in his address, he marked it out at something under 1¼d. per unit; and no doubt 2d. would be ample to cover the cost of electricity generated by gas-engines in towns where the cost of gas was from 3s. to 4s. per 1000 cubic feet. Therefore, if people were prepared to take the trouble and risks of looking after the gas-engine, they could obtain their electric light at very much less cost than it could be supplied at from a central station. They would all agree in congratulating Mr. Holliday on having prepared a very careful and interesting paper.

Mr. HOLLIDAY, in reply to Mr. Glover, said the consumption of gas was per indicated horse power. Possibly the fluctuations of light were more due to defects in the gas-engine itself than to any other cause. As had been pointed out by Mr. Irving, Messrs. Crossley were now supplying gas-engines guaranteed to work with a minimum amount of variation; and, with the degree of efficiency quoted, there ought to be no difficulty in maintaining a steady light. Mr. Tobey strenuously advocated a differential rate on account of the development of the day consumption of gas. But if they allowed a differential rate for motive power on this ground, why not do so to those who used cooking and heating stoves, coffee roasters, and other apparatus, which also led to day consumption? Then how was the consumption to be ascertained? Were they to have a separate meter in each case? It seemed to him that they would have to increase their capital expenditure to a considerable extent if they were to carry out this idea. He did not see how they could consistently separate motive power from cooking, heating, or many other industrial purposes. Mr. Belton had given strong testimony in favour of the use of gas-engines. He (Mr. Holliday) would like to mention that he did not advocate gas-engines simply for intermittent use only, but contended that for such purposes—as Mr. Carr had pointed out—it was impossible to compare any other prime mover with it. The point made by Mr. Lees with regard to having gas-engines on gas-works was certainly one which every gas company ought to make a note of, because if they could not find a use for these engines on their own works, how could they recommend them to other people? Taking the discussion as a whole, the opinion seemed to be that a differential rate had not a sufficiently large number of points to recommend it as a principle to be admitted into gas administration. One gentleman raised the question about competition with Dowson gas. In reply to that, he (Mr. Holliday) would ask: Supposing it was shown that Dowson gas could be produced for (say) 2s. 6d. or 2s. 3d. per 1000 cubic feet, and the price of the ordinary supply was 3s., were they to go on underbidding the Dowson gas simply to secure custom? It seemed to him that the position was somewhat untenable.

DISCUSSION ON MR. E. H. STEVENSON'S PAPER.

[See *ante*, p. 1330.]

The PRESIDENT said the subject of this paper was one that affected many members of the Institute, and would affect others in the future; and it was therefore well suitable for discussion.

Mr. W. A. M. VALON (Ramsgate) said it appeared to him that the author had put very carefully before the meeting the fact that there was no principle that governed the transfer of gas companies to local authorities. The idea which always governed these transactions was on one side to get as much as they could, and on the other to pay as little as possible. This was the *modus operandi* which all experts were expected to follow in valuing an undertaking; and the great difficulty, when deciding the value, was that on one side it was represented as a perfect gold mine, and on the other as a poor thing. The consequence was that, in conjunction with other circumstances referred to by Mr. Stevenson, the prices were fixed at a varying number of years' purchase; and he feared that any discussion on the subject would not relieve them from this difficulty, or afford much guide to future transactions of the sort. Mr. Stevenson had referred to the three conditions under which purchase might take place—viz., the first, by the local authority agreeing to pay the value placed upon the undertaking by the company; the second, that where the company were willing to sell, and the parties could agree upon the price, an arbitration should take place to ascertain the value; and, third, where the company were compelled by the authority of Parliament to sell their undertaking. The second and third terms were practically the same; but with regard to the first, he seemed to think that companies, being always in a position to demand more for their works than they were absolutely worth, did so, and that, on the other hand, corporations were in the habit of offering less. It so happened that within the past few weeks two cases had come under his notice diametrically opposed to this proposition. In one, the gas company positively refused to ask what he knew to be the value of the undertaking. They offered it at an extremely low price to the corporation, who, on their part, were very willing to buy, or pretended to be so. But the result of this offer was, as might have been anticipated, not satisfactory. The chairman of the company had held the office for forty years; and, seeing the company had earned a clear dividend out of the town for a very long time, he was willing to part with the undertaking to the council at what he (Mr. Valon) considered to be too low a price. The result was that the corporation received the offer with suspicion. They said: "There must be something behind which we do not know anything about, or why should they be so willing to sell?" And they then hedged the proposed purchase about with the condition that they would buy at such and such a price, provided the Local Government Board would give their consent to their taking over the concern. When, in due course, the Local Government Board inquiry took place, it was found that the corporation would have to supply outside their municipal district, and would therefore require an Act to give them the necessary power; and they immediately said to the company: "If you want us to buy your undertaking, you must pay half the cost of our going to Parliament to get this Act"—showing that the good intentions of a company were not always rewarded by appreciation. Another case was that of a water company in a large town; and there he was advising the corporation with regard to the purchase. Absolutely, after he had fixed the price that he thought might fairly be offered to the company, they asked him whether it was not possible to extend the terms; they being willing to give more than the sum he had advised. He admitted that these two cases were unique; but in them, at any rate, the principle referred to did not hold good. What Mr. Stevenson had said as to details was, as a rule, no doubt correct. But there must always be a wide divergence between two parties to a bargain—the one not wanting to sell, and the other wanting to buy. Under these conditions, the only possible mode of arrangement, failing agreement, was to go to arbitration.

Alderman MILES (Bolton) remarked that he could not

say much upon the question before the meeting, as there was really not much room for discussion, taking the title of the paper as it stood; but if it could be changed into the question of the advisability or wisdom of transferring gas undertakings to local authorities, there might be interesting matters brought forward which would cause some discussion. As to the wisdom of such a course, were he the manager of a flourishing company under a body of considerate directors, he should prefer remaining as he was; but, on the other hand, if he was a member of an enterprising gas committee under a corporation that did not possess the gas-works, he should be inclined to advocate the corporation acquiring the works. His experience, taken altogether, showed it was a wise course, from an all-round point of view, for corporations to own gas undertakings; and he had been led to this conclusion by his 22 years' experience at Bolton. There a flourishing Gas Company existed many years ago; and, as far as his knowledge went, they did their duty by the shareholders and the consumers. But, on the whole, the Bolton Corporation, being one which took a very comprehensive and intelligent view of their duty towards the consumers as well as the ratepayers, the transfer of the gas-works had been in the public interest. If he were to say a word about the disposition of the profits of the undertaking, and anything being applied in relief of the district rates, he knew he should raise a good deal of objection. But he was convinced that this was the correct course. He knew that on this point he was talking heresy, in the opinion of many; but he considered it to be the duty of every member to express his own individual opinion, even if it was not in accord with that of the majority. He contended that the works belonged to the ratepayers—they were the responsible people; and if the consumers' interests were properly looked after, the ratepayers were also entitled to receive from the profits some relief in respect of the rates. Their position in Bolton had been, and was, this: Besides keeping down the price of gas and giving a supply of the best description, they had been able, during 22 years, to relieve the rates to the extent of £200,000; and he ventured to say, large as this sum might be, the price of gas had been as low as, and probably lower than, it would have been if the Company had continued in existence. As to the state of the works and the general supply, he ventured to say they would compare very well indeed with any place in the United Kingdom. His argument would be that in that length of time an amount of profit had been realized which would otherwise have gone into the pockets of the shareholders; and they were sufficiently large-hearted to prefer to benefit a large number of ratepayers than a smaller number of shareholders.

Mr. J. Booth (Southport) thought it was a sound principle to take so many years' purchase of the dividends which had been paid, and also the condition of the works. These were two points which, he said, needed their careful consideration. He had known cases where the works had been starved almost to the utmost, and a very large number of years' purchase had been realized for the undertaking; but a company who adopted such a principle was very unfair to the purchaser. He believed in honesty on the part of both the buyer and the seller. It was impossible for anyone to state what the number of years' purchase should be; and no recognized principle could be laid down—it varied in each case. The question of the dividends paid, and the condition of the works, ought to be considered conjointly.

Mr. W. W. Hutchinson (Barnsley) wished to point out what he considered was an omission in the paper, excellent as it was. He thought the author should have given a little more information with regard to what he regarded as the proper principle to be adopted in making due provision or compensation to the engineer, secretary, manager, and other officers connected with the company. All the members would agree with him that the bulk of them did take such an interest in the company with which they were identified that their interests ought not to be entirely forgotten in the hurry and rush of determining the price between buyer and seller, as he was informed it sometimes was. This was a point on which they ought to have some information for the benefit of those officials who were connected with works which, in time to come, might be taken over by public authorities. He did not want to attach too much importance to this, because he took it that, to a certain extent, they were able to defend themselves on these points when the time arrived. But he did think there ought to be some more clearly-defined rule to govern this point than appeared to be the case, as far as he could at present understand. Another serious omission was the absence of reference to the low general rate of interest. Within the last ten years, the rate of interest obtainable for money in this country had so largely fallen that the number of years' purchase—twenty-five to thirty years—obtained for undertakings which were transferred (say) ten or twelve years ago, should be largely increased on account of the inability of the shareholders, who were paid off by the corporations, to place their money equally safely at the same rate of interest. He thought this item ought to have special attention at the present time.

Mr. T. N. Ritson (Kendal) said that the works with which he was connected were only recently taken over by the Corporation; the settlement being entirely an amicable one. In 1889 (three years before he went to Kendal), the Corporation approached the then existing Company to sell; but they could not agree on the figure asked by £2000 or £3000. Circumstances subsequently occurred whereby the Company were compelled to call upon their reserve fund, and clear it out; thus leaving them in a worse position by some £2000. However, after he took over the undertaking in 1892, the Corporation again approached the Company, and made the same offer as on the previous occasion, with the result that the Company regarded the offer as a good one for the shareholders, and a fair one for the Corporation; and thereupon the transfer was satisfactorily carried out. He did not think it wise that Companies when approached by local authorities should stand out for exorbitant figures; for it only made it all the more difficult for the purchaser to meet the liabilities when the time came. If an exorbitant price was paid, it fell hard upon those who had the profits to make. Moreover when local authorities took over gas undertakings, the consumers invariably expected reductions in the price of gas; but when loaded with capital, this was difficult to accomplish, and consumers wondered why gas could not be supplied as cheaply as in other and neighbouring towns, which happened to be more fortunately placed as regards capital. The gas consumer forgot to take into account heavy capital charges when making comparisons. This last year at Kendal, 91 per cent. of his gross profits (gas and water) went to pay the interest on loans and provide for the sinking fund. The capital per ton of coal carbonized was now £11; whereas under the old *régime* it was only £7 10s., which made a considerable difference in the selling price of gas.

Mr. C. A. Craven (Dewsbury) said that it had been his experience to serve not only a Corporation but a private Company, and to be for a number of years in charge of works without any committee at all. He agreed with very much of what Alderman Miles had said as to the desirability of public bodies acquiring gas-works. Among other things, if they were well managed, they became a benefit to the town; and he thought, with Alderman Miles, that the ratepayers who found the money, and were responsible for the capital of the concern, had the right to some advantages, though, of course, those advantages ought to be calculated on a reasonable basis. Some people had prophesied that gas-works would be done away with. If so, where would the responsibility rest for the capital? It would be on the ratepayers; not on the gas consumers, except so far as they were ratepayers. It was, therefore, only proper that the ratepayers who found the money should have some little compensation in the way of a portion of the profits. The paper, although short, was full of good sense and good suggestions.

Mr. G. R. Love (Dundalk) said the subject before them was not one upon which much could be said. He was interested in a Company which at one time the Corporation wanted to purchase; and they had the works valued by an expert, who put a very high price upon them. When he afterwards came to take charge of them, he found them in a very bad condition; and instead of being worth what the valuer said—about £40,000—he did not consider them worth half this amount. Since then the Company had had to renew nearly all the plant. He desired to protest against the system of over-valuation; and he thought some legitimate measures should be taken to put it down. Valuers ought to come within something like reasonable limits, and not fill the heads of shareholders and directors

with exaggerated notions as to value, which came very hard indeed on those who had to take charge of the works afterwards.

Mr. H. Lees (Hexham) said he felt a little disappointed with the paper because he expected to hear something as to the relative advantages of corporation and company administration. After listening to the various speakers, he had come to the conclusion that, for the sake of the gas consumers, the undertakings should remain with the companies. One reason, among others, was this: Mr. Ritson had told them that, where a very reasonable price had been paid, it took 91 per cent. of the gross profits to meet the interest and sinking fund. If this was so, and they had paid what might be considered a fairly good price, it would probably have taken more than 100 per cent. of the gross profits to pay the interest on capital and the sinking fund instalment. Alderman Miles said the ratepayers were entitled to something. But this must come out of the consumers; and he wanted to see where they were to derive benefit by the transfer of the gas-works to the corporation under such circumstances. That "something" was a very elastic matter, which might range from 2d. to 6d. per 1000 cubic feet. It was a serious item, and was so indefinite that it ought to be clearly laid down what, if anything, the ratepayers were entitled to as owners of the gas-works. As to these works being abolished, nobody believed this would take place in his lifetime. But, in any case, the capital value was being repaid by the sinking fund; and it was not the ratepayers, but the gas consumers, who were paying it. The ratepayers were never drawn upon to make good any losses if they occurred; but the price of gas was increased immediately. Then there was the question of personal interest in the concern. They all knew that men were elected upon corporations for a great many reasons; and very often they obtained seats on these public bodies for purposes entirely apart from the administration of the gas-works. No doubt the general feeling would be in accord with Alderman Miles, that, as gas managers, they would prefer to be under a company. Alderman Miles, being connected with the Institute, and having also an interest in a Corporation, would perhaps disseminate his views of the good feeling that should exist between a gas committee and their manager. The position of the manager under such circumstances would be more comfortable; and the corporations would be none the worse for the better feeling. Better results would be obtained, and the manager's life would be better worth the living.

Mr. J. Carter (Lincoln) thought the author had exercised a wise discretion in "leaving severely alone" the points which had just been mentioned. The most important contribution to the discussion was that made by Mr. Hutchinson; for no doubt the continuous process of the cheapening of money should enhance the value of gas undertakings when they were purchased, just as it enhanced the value of other marketable property. It was perfectly true that there was no principle capable of universal application to these cases. Each one must be determined in view of the particular circumstances that surrounded it. The paper left on his mind the impression that there would in future years be plenty of work for the expert—for the skill of the engineer as well as the ingenuity of the advocate—in determining the amount to be paid. Alderman Miles had certainly opened out a very attractive subject in his remarks. He was just the man to do it. But he had raised a question on which perhaps the less said the better; and he (Mr. Carter) only suggested that the worthy Alderman should not conclude that, because many of them were silent, his position was therefore unassailable.

The President said he thought the principles of transfer were admirably summed up in Mr. Valon's remarks—on the one side, to get as much as you could; and on the other, to give as little as possible. The true balance was only to be found by a careful investigation of all the circumstances in connection with the works; and this could only be done by experts, after a good deal of inquiry. As to the question of the desirability or otherwise of works being administered by corporations or by companies, that was quite another subject, and was capable of being advocated from either side in such a manner as to lead to a long and interesting discussion. If some of those gentlemen who had referred to it would be good enough to come forward another year with a paper upon it, it would no doubt receive every attention. He was sure they were all glad to welcome Mr. Stevenson, on this his first appearance as a reader of a paper.

Mr. Stevenson, in reply, remarked that, though he was a new contributor to the papers, he was an old member, and one who had stuck to the Institute through all its troubles. He was exceedingly pleased at the discussion which had taken place, which had, to a certain extent, put some fresh life into the dry bones of the paper, because he could see that, underlying what Mr. Valon was good enough to call the natural principles—or, as he almost called it, the utter want of principle—he had shown in the paper, there was a good deal of feeling on various points. One of them that seemed to affect his hearers most was that of which Mr. Humphrys had spoken—viz., that there should be proper consideration to the engineer and manager, and other officials of the gas company, when they were transferred. He quite agreed with this; and he had never in his life thought of advising clients, or, if he could possibly influence them, allowed them to treat a permanent official of the company they had taken over, in any other way than the company would have treated him. But his experience pointed to this, that anyone—unless the works were abolished altogether, as in the case where a very large corporation bought a small works—who was dismissed when the transfer took place, had himself very largely to thank for it. He had known men fight for their companies with their backs against the wall, and fight hard, who had simply gained the respect of the local authority, and been trusted ever afterwards; as one who really worked honestly for his company while in their service had nothing to fear from the local authority when he became their servant. With respect to the value of money, that was hardly a principle of valuation. It was a thing upon which an expert giving evidence might have an opinion, but hardly one on which it would be right for him to express it any more than the exact number of years' purchase which ought to be given. This depended on the value of money and on the state of the works, and it might be on other circumstances; and without knowing the facts of any particular case, one could not give any number of years' purchase for it. He did not think it at all necessary to go into the question of whether the local authority should utilize the profits to pay off liabilities or to relieve the rates. His own opinion was that it was better to pay off the debts first, because in future years they would have greater profits for the relief of the rates at a time probably when they needed it more, for they all knew that rates were going up in every town throughout the kingdom, and never coming down. Mr. Ritson had referred to the works at Dundalk, which he knew very well; and he had not much sympathy with a Company which, when they acquired works, doubled the capital, and divided the "watered" shares among the shareholders. This was what that Company did; and they had to pay dividends upon double the capital, or a portion of it. So that capital did sometimes go up, even under the administration of companies, and not always rightly. Though it had been said that there was no principle in the paper, he thought it was choke full of principles; and he still adhered to his opinion. It seemed that, underlying the general principles of transfers, there were two main questions which often did, but which ought not to, arise—viz., give as little as you can, and get as much as you can. The proper way was to ask a fair value and to give a fair value. He always tried either to offer or to demand a fair value—never unduly pressing the scales one way or the other; but he did weigh every point which told for or against the company. The great cause of the variation which occurred between different valuers was the different point of view from which they looked at the matter; and, on the whole, he believed that they were honest in their opinions.

Discussion on the Papers by Messrs. Humphrys and Dougall.

[See *ante*, pp. 1331, 1333.]

Mr. G. Anderson (London) said these two papers were, in his opinion, the most practical, serviceable, and useful papers which had been read at the meeting. It was quite evident that the authors thoroughly understood their subject, and had given it great attention; and certainly one of the best ways of increasing the supply of gas to

the public was to give them the requisite accommodation, and to have a skilled person attending from time to time to furnish them with necessary instruction. At Cork, Mr. Travers had been for years engaged in this way, and had been very successful. He kept a mechanic for the express purpose of going round the whole city, wherever they had apparatus, especially gas-engines, in use—not waiting for complaints, but seeing that everything was in order. The mode of dealing with the difficult case of the coin meter explained by Mr. Dougall, was a very good one; but he had gone one step farther. Mr. Dougall said he put the amount delivered for a penny a little less than he expected it to be, and gave back the coppers. This was a very good plan; but he went farther than that. When he had a consumer in arrear, who was any trouble to him, and he had been for some time thinking about cutting off his gas, he told him he must pay on the coin meter system, and if he did not accept this, he should stop the supply of gas. The consumer generally accepted the offer; and he then put on the meter rather more to his advantage, so that he might gradually wipe off the arrears. They were honest enough to re-arrange it to the proper quantity when the arrears were wiped off. Mr. Humphrys, who was a practical man, seemed to have gone thoroughly into the question of hiring. But he would find that it was a very awkward thing to have a lot of cookers or anything else on their hands; and they all knew that there were new and important gas-stoves constantly coming out. It was therefore very advantageous to get people to buy these things, even if they sold them at trade price. Then they would not have so much trouble by having them returned; and it would be no evil to the customers, because the articles might be very good, although not quite so new-fashioned as something else.

Mr. H. Lees (Hexham) said these two papers were of great interest to the gas profession. He apprehended it was always their endeavour to extend the use of gas; and in this the introduction of penny-in-the-slot meters and the hiring of gas cookers would always play a prominent part. He agreed with Mr. Humphrys that proper agreements should be insisted upon, and that the apparatus should be let out on easy terms, and at least one year's hire claimed. They could often let out a gas cooker for a few weeks or months, if the consumer could be assured that at the end of that time he could send it back; but this should be avoided. He (Mr. Lees) quite appreciated the remark that in the case of small companies they should confine themselves to one maker. A multiplicity of makers only added to the confusion, and increased the difficulties. The fixing should, he thought, be done free. The only payment the consumer required to have was a quarterly one, at the usual time. He did not want to be troubled with any initial cost; and he (Mr. Lees) believed that, where it was insisted upon that the consumer should pay the cost of the fitting, it was a considerable drawback to the extension of the business. It was a very easy matter to include it in the rental fixed. Coming to Mr. Dougall's paper and the use of prepayment meters, if they were supposed to supply from 20 to 25 cubic feet of gas for a penny, and their consumers were given to understand that this quantity would furnish one light for four or five hours, it was important that governor burners should be supplied; for if the consumer had a burner which consumed 8 or 10 cubic feet in an hour, he became dissatisfied. His own experience was that, for lighting purposes only, this system did not pay; and had it not been for grillers and cooking-stoves, it would not be worth while introducing it. He had been able to overcome the difficulties mentioned by Mr. Humphrys of dealing with the old cookers. A few years ago, they had a gas exhibition, at which cookers of a very modern type were shown. The result was that some of the consumers desired to make exchanges; and they gradually had some of the old cookers back. But he had no difficulty in placing these with prepayment consumers, who were glad to make use of them. The lecture scheme propounded by Mr. Dougall was an exceedingly good one. The only difficulty would be in getting a really suitable lecturer. Mr. Dougall seemed to have been fortunate enough to secure one. Then with reference to the discrepancy between the registration of the meter and the cash found therein, he did not think it was a wise thing to cavil over the matter. If they had a few pence short, it was much better to take the responsibility of it. On the other hand, if they began returning 2d. or 3d. in the same way, it would be likely to create want of confidence. The meter was supposed to be accurate; and if, time after time, they had either to ask for additional money or return it, that confidence would certainly be lost. Of course, there were exceptional cases, which must be dealt with on their own merits. The disposition of the coppers had been no difficulty in their case. Their average consumption was about 8000 cubic feet per annum. As to the cost, he noticed that Mr. Dougall included the service-pipe in his estimate. But in many cases they fixed the service-pipe free of charge; and therefore he did not think it was legitimate to charge it as an extra cost on these houses. He included in the estimated cost the meter, the service, and the whole of the fittings (which would embrace the boiling-ring), at £3 16s. 3d.; and if they put £2 for the meter, it did not leave a great deal for the service and other things.

Mr. W. A. M. Valon (Ramsgate) said he believed he was the introducer of short payments in England; and at Ramsgate the system had answered very well—increasing the number of their consumers 33 per cent. A coin meter was not used, but a prepayment index meter, which did away with any kind of error or discrepancy between the money paid and the quantity of gas registered, as well as leaving the instrument entirely under the handling of the Corporation inspector, with a great saving of labour and economy in working and without the nuisance of getting rid of copper coins. He would like, if possible, to have any remarks deleted from the report of the proceedings which suggested the practice of arranging the coin meter to register fast for the purpose of covering any loss there might be from the difference existing between the coins and the registrations of the index. He thought they were bound by the instrument they supplied; and if it were incorrect, and entailed any losses, they should put up with it rather than seek to correct it in this way. He might say to his friend Mr. Anderson that he very much objected, as a member of the Institute, to anything being attached to the proceedings to show that they favoured the idea of fixing the coin meter in such a way as to collect arrears of payment due from any consumer. He should also like to say that, as an investment, there was not the slightest doubt that the supply of gas on the short-payment system was the proper thing for gas companies to undertake. If they took the average given in the paper of £4 per house, at rentals ranging from £10 to £35 a year, and if they added 1000 consumers to the list, it meant a capital outlay of £4000; and he ventured to say that no one purchasing a gas-works would object to £4000 being added to the capital account, if by such means they could add 1000 consumers to their roll. But, as going concerns, the £4000 could only be looked upon as a temporary loan; as the additional charge usually made, of ¾d. per 100 or 7½d. per 1000 cubic feet, was sufficient in five years to pay off the original investment, securing after that time to the company or corporation additional revenue, or allowing them, if they thought fit, to reduce the price to the level of the figure charged to the ordinary consumers. His experience, from beginning to end, of the short-payment system was that it was thoroughly successful, and the best way to proceed to popularizing the use of gas. He looked forward to the time when all gas accounts would be collected monthly instead of quarterly. The advantage of such a system was apparent, and accentuated by the prepayment system. It was true the necessity would arise for more inspectors and clerks (there were plenty of them always waiting for employment), and a larger administrative department; but the gain to the company or corporation would justify the necessary expenditure. Small accounts were more readily paid than large ones; and a monthly account of £1 was more easily collected than a quarterly one of £3.

Mr. Isaac Carr (Widnes) said he had done something in the slot meter business himself, and his experience might be of interest. At Widnes, prior to the introduction of the system, they had not a very large number of consumers in proportion to the number of houses in the town; and it was always a vexed question how to increase them. The works had been established about five-and-thirty years; and up to eighteen months ago the total number of consumers was only 1500. They then introduced the slot meter system; and in about eighteen months they had an increase of 2500 consumers—making a total of 4000. Some reference had been made to the gas business dying

out; but this fact was an indication, he thought, that it was still capable of great future development. One thing which might have had a little to do with their success, was the generosity with which the Corporation authority at Widnes dealt with all gas consumers. They supplied 30 cubic feet of gas for 1d., and fitted up the houses complete free of all charge. This, no doubt, had been a great factor in bringing in the new consumers at so rapid a rate. There was no other means, either with oil or candles, by which they could obtain the light at anything like so low a figure as gas at 30 cubic feet for a penny. The consumption was not quite so large as he had thought it would be—only 9000 cubic feet per annum. But it paid; and no doubt, as the system became better known, they would use gas more freely for cooking purposes. He would recommend anyone whose business wanted a little fillip to introduce this system, if it had not already been done.

Mr. W. D. Child (Romford) said he rose principally to refer to the remark of Mr. Lees, who appeared to favour the idea that, if the measurement of the meter did not correspond with the money in the box, they should give it in favour of the consumer. He (Mr. Child) did not think it was wise for gas companies, or for a meeting like theirs, to let it go forth to the public that the measurement of meters was not correct. It would be much wiser if they endeavoured to teach the consumer that the meter itself would measure correctly, but that, up to the present time, the adaptation of the automatic payment of the money was not, perhaps, absolutely correct, and that all agreements between the consumer and the company should be based upon the idea that the gas was measured accurately, and should be paid for. In every agreement he had entered into with consumers, he had made this the basis of the arrangement—that the quantity of gas registered on the ordinary index of the meter should be the amount paid for. The collectors also distinctly understood that, if they found more money in the meter than there should be (which was quite as often the case as a deficiency), the account was to be immediately corrected between the consumer and the Company. In this way, an amount of confidence grew up between the consumer and the Company which would not otherwise exist. They should not admit for a moment that the gas-meter was not a correct measuring instrument. He had often offered, if the consumer would go to the expense of having it done, to fix and pass gas through three meters consecutively with a guarantee that there should not be 5 per cent. difference between them. He should not like to stake his faith so absolutely upon the automatic principle; but he certainly expected to be paid for the gas registered on the original meter index.

Mr. J. R. Smith (Padiham) said the coin meter of a few years ago was not the coin meter of to-day; and some of the discrepancies referred to did not now exist. His experience had been similar to that of many other members. They had been waiting for some time for an almost perfect coin meter to come into the market. There was considerable trouble when they were first introduced; and he remembered asking a brother manager who adopted them what was the result. He told him that some registered more gas than was paid for, while others registered less; but, taking them altogether, they came about straight. This did not satisfy him; for he thought they should have a meter which would register correctly. He was sure members would derive much profit from the study of the two papers. He agreed with Mr. Dougall as to the necessity for having homely lectures. Some of those given at gas exhibitions were very able; but they were considerably over the heads of the audience. He did not adopt the coin meter until the beginning of last year. They had 1700 consumers, and 100 coin meters, which, he believed, were all working satisfactorily.

Mr. Lees said he should not like it to go forth that he had impugned the accuracy of the gas-meter as a registering instrument. What he had said was that they should not trouble about the question of a few pence being over or short. This did not alter the registration of the meter.

Mr. T. N. Ritson (Kendal) said he was quite in accord with Mr. Valon that it would be most disastrous if it went forth that the accuracy of prepayment meters was not to be depended upon. According to the Sale of Gas Act, gas-meters were "legal measures." A few years ago, they had an interesting case before the Court at Kendal, where there was a difference of about £2 between the money found in the box and the amount registered as due by the meter-index. On sending the meter to be tested, it was certified as correct; and yet the County Court Judge gave the case against the Company. It was quite time the Institute, or the gas world generally, took steps to see that these automatic meters were also made "legal standards;" otherwise gas companies were at the mercy of County Court Judges, who might give their opinion one way or the other. The meter-index was a legal standard; and County Court Judges ought to abide by the Sale of Gas Act. Last year they had a successful exhibition in Kendal; and during the year they fixed 205 gas-cookers, free of cost, on the hire system. The net outlay was as follows: Cookers, £844; meters, £208; material for fitting up, £97; time, £61—making a total of £1210 for the 205 cookers. The rental returned them 8 per cent.; and the consumption about 10 per cent. So that, altogether, they had a return of about 18 per cent. on the outlay, which was, he thought, very satisfactory.

Alderman Miles (Bolton) said he had for many years taken a warm interest in the subject of the two papers. With regard to that by Mr. Humphrys, he agreed with practically all the author had said. Such had been the impetus given to the cooking-stove trade, that in their town they had in actual use about 8000 or 9000 stoves, many of which had been purchased. Some years ago, they adopted the hire system; and it had taken very well. But the part of the business which had given him the greatest satisfaction was the small grillers. At the present moment, there were in the cottages at Bolton no less than 1500 in use, giving perfect satisfaction; and he recommended his manufacturing friends in Lancashire and Yorkshire to take up this matter, and bring it under the notice of the working-class population. By this means, they would obtain a marvellous success. He remembered having once to address an audience in Bolton on a political question; but he took the opportunity of saying something about the department with which he was connected, and of recommending the gas-grillers to the working classes. When people had to get up at five o'clock in the morning to go to work, a little instrument by which they could boil their kettle or cook a little bacon or a chop was a great advantage to them; and when it was brought under their notice, they readily took advantage of it. With regard to cookers which were getting obsolete in consequence of the numerous exhibitions which were being held up and down the country, they had for two years past kept a man doing nothing but bringing these stoves up to date. Of course, this had caused a large expense; but they were now giving great satisfaction. They did not get anything in the way of profit on the hire—in fact, they lost money by it; but the quantity of gas consumed made up the difference. With respect to the prepayment meter, he was a warm advocate of this principle from the moment he saw the first meter of the kind placed on the table at a meeting of the Institute. In their town, it had worked remarkably well. There were now 2500 of them doing excellent work—the consumption being 8000 to 10,000 cubic feet per annum per meter; and these, in conjunction with the grillers, had done very great service. Gas managers must look in these two directions mainly for an increase in consumption of gas in future. They had lost at Bolton two or three very large mill consumers, who had adopted the electric light supplied by their own installations; the rentals amounting to £700 or £800 a year. This was a great deal to make up; but, notwithstanding it, their increase last year was 7½ per cent., which showed the utility of these new methods. With regard to the vexed question of how to deal with deficiencies in the slot meters, at first they had a great many. But he should hesitate very much before recommending his Committee to adopt any means which would give the customer the idea that they were trying to fleece him in any way. He would rather make a respectful application to the makers of the meter to refund the amount which was short, and so put them a little more on their "mettle." Of course, a new instrument like this could not be expected to be perfect; and he sympathized with the difficulties of the meter makers. He believed, however, the meters could now be absolutely relied upon.

Mr. R. Porter (Elland) said he was not quite in sympathy with Mr. Humphrys in his strong recommendation of letting out apparatus on hire. He had had some years' experience of it, and had discarded it—preferring to supply

the apparatus at cost price, and pay the carriage and the cost of fixing. With a consumption of 90 million cubic feet, they had upwards of 700 cookers, which had been bought and paid for by the consumers. With reference to the coin meter, he thought they were all of one mind in regard to it—that it was the system of the future. As to the cost of fitting up meters, no one had referred to it except Mr. Dougall; and to his (Mr. Porter's) mind, the figure named was somewhat excessive. He should like to hear what it cost at Bolton and other places, where they had a large number at work. In his own case, the cost complete, with the meter service and a small griller, was £2 16s. 9d. per consumer; and the extra price they obtained for gas through the prepayment meter paid 7½ per cent. on the outlay. As to the increased price, Mr. Dougall charged 11½d. per 1000 cubic feet, which he (Mr. Porter) thought was somewhat excessive. They charged 7½d. extra at Elland; and before long he believed they would be offering to supply at 5d. extra. Their consumption was not quite so large as had been mentioned by some other speakers—only averaging 7500 cubic feet per consumer.

Mr. J. Andrews (Langley Mill) said that, when he came to the meeting, he was not in favour of letting consumers have anything for nothing, as his experience led him to the conclusion that that which cost nothing was worth nothing. After the discussion he had heard, however, he would not say anything further on the point, although he was still of opinion that in whatever the consumer had, he ought to have some interest at stake. The point in Mr. Dougall's paper which struck him as being strange was where he said he let certain work to a contractor. He (Mr. Andrews) had never heard of this system being adopted before; and it seemed to him to be a peculiar method. Here was a Gas Company who advocated the use of gas-fittings of various kinds, and had men capable of doing certain work in connection with them; and yet when the work wanted doing, they let it out to a contractor. His Company was rather a small concern; but they kept a man capable of doing this kind of thing, who fitted up houses with compo., iron, and brass fittings as required. Mr. Dougall had also referred to the question of various meters. Many managers objected to use different kinds of prepayment meters; but it appeared to him that, if they wanted to find which was the best, they should have at least one of each sort. He had only recently adopted these meters, and had now about 240 in use. He had a great many of certain makes, but one or more of almost every kind in existence. He found there were now some which came out fairly accurate. He tabulated the last collection from the various makers, and found in several cases a difference between the gas represented by the meter index and the money amounted to almost 20 per cent. In another instance, there was only 4d. wrong in 48 meters. It was evident, therefore, that they were going in the right direction, and would soon be able to make the money agree with the gas.

Mr. W. Carr (Stalybridge) said it was almost a pity Mr. Porter's remarks had not come immediately after the paper, as they would have put some spirit into the discussion. He started off with the statement that he had abandoned letting out cookers on hire, having found it a failure—a point which had never been raised before so far as he (Mr. Carr) knew. As Mr. Humphrys had pointed out, those who had used gas-stoves for any length of time, and let them out, found difficulties through the rapid improvement made in cookers—the old stoves being returned on their hands through consumers having found out that there were better ones to be had. This was very embarrassing at the time; but in the end it was not a real objection, but rather a benefit, as Alderman Miles had pointed out. Though it entailed considerable expense, it was far better to bear it, in the interest both of the supplier and the consumer of gas; and even though a great deal of trouble was encountered, he did not think hiring out could be regarded as a bad practice. In the first place, it was evidence of the confidence they had in the article they were offering; they did not feel any misgiving as to its being returned. If it was a new thing to the consumers, it was a great inducement to them if they knew they could return it in case of failure. He liked the idea of regular inspection which some gentlemen had applied. All kinds of hired apparatus of this kind ought to be frequently inspected, because many people would have appliances on hire with the idea that they had not much responsibility in regard to them, and might return or retain them, or use them so as to become unworkable, and let them remain in abeyance—even paying the rent rather than use or return them. He had known cases of this kind. He did not think the last speaker was quite justified in alluding to Mr. Dougall's system as letting to a contractor. It was more a question of piece-work. It appeared to him that the work was let to a man who was really a servant of the Company, but who did the work at a certain price per house, instead of at so much per day; and he (Mr. Carr) thought this was a very valuable suggestion. He also liked the recommendation to take care that the fittings were of good quality. It seemed to him that the builder and the plumber were two of the principal enemies of the gas supplier. Mr. Dougall said that builders advised people to have houses wired for electricity for a purpose which might be to the advantage of the builder only—it certainly could not be to that of the occupier. They also knew that plumbers who contracted for fitting up a house with gas generally obtained the contract at as good price as they could, and generally put into it the cheapest kind of material. His brother (Mr. Isaac Carr) might have stated that at Widnes the bulk of the houses were built absolutely without either wire or piping, or fittings of any kind. Even a very good class of cottage property was built without any provision whatever for lighting; so that the Corporation in that case were obliged to take up the matter, and fit up the houses, as the landlords absolutely refused to do anything of the sort. A case came under his notice not long ago in which gas suppliers were enjoined to charge very high prices for the materials they might use for fitting up gas appliances, lest they should undersell the plumbers in the town; and the prices must be kept up so that the plumbers could have a good profit. It was needless to say that the advocate was a plumber himself—and a member of the Gas Committee. He agreed with Mr. Valon that it was not to their interest to charge a little more with regard to prepayment meters, or to do anything the meter did not fairly warrant them in doing. A coin meter could now be made as accurate as any ordinary gas-meter. Such a thing as absolute accuracy, even with a gas-meter, had not yet been attained; but so long as the coin meter would work as near to it as the ordinary meter did, they ought to take the meter's statement. He had derived a great deal of information from the two papers, which were a valuable contribution to the proceedings of the Institute.

Mr. R. G. Shadbolt (Grantham) said it was an old saying that everybody knew his own circumstances best; and he supposed that it was much the same with gas managers. Mr. Porter had a total of 3500 consumers, and out of them he had 700 who were using gas-cookers; and as he told them they were all bought and paid for, this was an average of one in five. He (Mr. Shadbolt) considered that, if they could secure one consumer out of seven or eight as a gas-cooking consumer, they did very well. When it came to one in five, it spoke favourabiy for the system. The district referred to was within eight miles of the one of which he had had charge for some years, where they had not twelve users of cookers out of 5000 consumers; but they were an entirely different class of people. If members knew Elland, they would understand that the people there were of a very independent turn of mind, and preferred to buy outright than go on paying for hire. With regard to the prepayment meters, when he introduced the system at Low Moor, he had a gradual, but regular, reduction in the quantity of gas passed per meter. The collections were made monthly; the increased price being between 11d. and 1s. per 1000 cubic feet over the ordinary charge, to cover the additional cost. But from 11d., the average gradually decreased until it came down to the ordinary selling price. There was a reason for this. The district was an entirely different one from Grantham. It was a milling district; and most of the families there closed their houses during the daytime—the father and sons going to the ironworks, and the mother and daughters to the various mills. They therefore did not use much fuel of any kind, nor did they go in for a great deal of illumination. They consequently had a low average consumption per head. When he first introduced the prepayment meter, this remark was made to one of the inspectors: "I suppose, when we get this meter, when we once put in the penny, we shall have to keep the meter running till the penn'orth is done?" The people had the idea that when

once the gas was turned off, they could not get any more light for the penny—just as they might go to the railway station and get a pennyworth of sweets, or whatever it might be; and it took twelve months or more to explode that notion. The next stage was this: When they had put the penny in, they never put in another until the light had gone out. He had known families sitting in a state of darkness, with a light not so large as a finger-nail, waiting for it to go out before putting in another penny. This accounted for a great many discrepancies in the meter. It was only after twelve months' hard work that they could get consumers to understand the thing. The inspectors gradually taught them that, if it cost 6d. a week for light, when the "boss" came home on pay-day, they should "put six pennies in, and have it done with." As soon as they got consumers into that way of working, the average went up again to its normal quantity; and it was going on now with a fair amount of success, although the meters had been somewhat strained, which, of course, brought the wear and tear to a maximum. At Grantham, the other day, one of his inspectors, who collected the monthly money, pointed out to him that a certain consumer was 4d. short, and asked what he should do. He inquired of the inspector if he thought they had tampered with the meter. He replied that he was afraid they had. They therefore changed the meter. But when he came to trace the matter for six months from the fixing of the meter, he found the money was quite correct. The fact was that they had got into certain ruts. They always sold gas by the 1000 cubic feet, and had not become accustomed to selling it by the pennyworth. When they went to an automatic machine for a pennyworth of sweets or a cigar, they took their chance; and in the same way when they put their penny into the meter, they took their chance whether they obtained a little more or less. He would suggest to meter makers that, instead of the ordinary finger showing 1 foot, 1½ feet, or 2 feet, they should put one which would register 10 feet from one division to another—say, 50 feet to a revolution, divided into tens. They all knew the mistakes made by the ordinary meter, especially with the 100 pointer. The inspector was expected to take it at the nearest figure. But when they were supplying 25 cubic feet for a penny, it was a question of 4d. between one figure and the other; and he thought this accounted for many of the differences in the monthly collections. After about six months' trial of 80 meters, when he summed up the total, they agreed to a penny.

Mr. A. Graham (Mansfield) said the plan he adopted was the three years' hire-purchase system; and he found that it answered best.

The President said there was one point he must refer to, as it seemed to have been taken seriously, and that was Mr. Anderson's suggestion as to the best means of recovering arrears. He thought that gentleman was joking a little, and that what he said was not to be taken seriously. It was a question with him (the President) whether the time had not arrived when the prepayment attachment of the meter should be standardized in such a way as to ensure the consumer getting his equivalent for his money in the quantity of gas supplied. In all probability, it would have hampered the introduction of these meters if this had hitherto been insisted upon by the Legislature; but the time would come, if it had not actually arrived, when he thought Parliament would step in and insist upon prepayment meters being stamped in the interest of the consumers. Reference had been made to the difficulty of the disposal of obsolete cookers; and those who had been accustomed to letting out cooking-stoves on hire must all have experienced this in times past. There was only one way of getting over the difficulty, and that was, when the cooker became obsolete and worn out, to put it on the scrap-heap, and replace it by one of more modern manufacture. At Nottingham, they did not hesitate to break up cookers whenever they showed signs of decay, or were being superseded by a better class of stove. It was easy to set aside a certain sum each year, which would provide for breaking up all obsolete stoves and providing better ones. He was not at all in accord with the notion of putting forward artificial attractions for gathering together a number of consumers. In some cases, very excessive attractions had been offered; and the consequence had been that complications had come in to such an extent that the companies who presented all these attractions had to stop entirely the distribution of them until they were in a better financial position as regards capital. As an illustration of what could be done without such artificial attractions, he might mention that in Nottingham they had put in upwards of 3500 meters since they commenced some six years ago—fixing them at an average rate of about 600 a year; and they had never solicited a consumer after the first 25 had been fixed. They came in regularly and spontaneously. They fixed the meter free of charge, but they gave nothing else; and the consumers found their own fittings and boiling-stoves. They provided them with a governor burner, so as to ensure their burning the gas a certain fixed number of hours for the penny; but beyond this they gave them nothing. He might add that there were no consumers who showed a higher appreciation of the advantages they obtained than those who took their gas by prepayment meters. He was quite sure this system would extend enormously in the future. It had gone on at a rapid rate in the past; but they did not even yet perceive how great an advantage it would ultimately become to all suppliers of gas—in fact, he believed the field for it was almost unlimited.

Mr. Humphrys said, although the discussion had been somewhat long, there was not much to reply to. So far, the object he had in bringing forward the paper had been carried out. He thought the question of letting appliances on hire might well receive a little consideration. Mr. Anderson had mentioned that it was as well to sell stoves if possible; and he (Mr. Humphrys) preferred to sell, even on liberal terms, rather than let them out on hire. But if people would not buy, what was to be done? He had tried in more than one place both to sell right out and on the hire-purchase system; but he found that the amount of business to be obtained in this way was a mere fraction of what he could secure by letting on hire. With regard to the question of slow meters, he must say he had some sympathy with the various speakers on the point, because a slow meter was always a great deal more trouble than a fast one. If a consumer had a meter which went 30 or 40 per cent. slow for a year or two, in his experience there was a great deal more trouble when they took it out, and put him in a proper one, than when they had a consumer who had a meter which had gone fast. If, after paying about £3 a quarter, they put in a meter which brought the consumption up to the proper amount of £4 or £5, the consumer would have it that he was being cheated out of the extra amount he was called upon to pay. He quite agreed with Mr. Andrews' remark that it was not well to let a consumer think they were going to give something away. He always endeavoured to bring it before the consumer that they were not giving away anything in letting out stoves on hire. They were not seized with a fit of good nature, and anxious to give away a few stoves; but they looked for a steady and permanent increase in business and in consumption of gas which would more than recoup them for the extra expense of the stoves. Mr. William Carr had very rightly laid stress on the importance of the inspection of apparatus. This was very necessary, because people would not in many cases send to complain if they had a bad supply to the griller or a boiling-burner went wrong. They put up with it, or perhaps went back to the kitchen range, and forgot it from week to week; and so they did not get the consumption they would secure by regular inspection, and keeping things in order. The fact of the inspector calling at once attracted the consumer's attention to the appliance, and altogether tended to bring about a state of things they all desired—a regular consumption and an interest in the apparatus. With regard to lectures and demonstrations, he had a great preference for what Mr. Dougall happily called the homely kind of cookery lecture—something done in a quiet sort of way, without any very great elaboration. A series of cooking demonstrations on a small scale would attract the attention of users of stoves, and lead to their further introduction.

Mr. Dougall said it was only after much hesitation that he decided to read his paper; but he was now very glad he had done so, because it had elicited so much useful criticism. Most of the remarks had been in sympathy with the paper. There were, however, one or two points to which he must reply. With reference to the question of "shorts" and "overs." In the first instance, the consumer was asked to sign an agreement to be bound by the registration of the meter. But they had a class of consumers to deal with who were sometimes rather unreasonable; and while they were ready enough

to take back any "overs," they would not pay for the "shorts." He thought, as he had stated in his paper, the better way to deal with them was to set the automatic attachment of the meter a little back—he did not say a great deal, but in a case where one was giving 21 cubic feet of gas for a penny, set the meter at 20, and if there was a little money over return it to the consumer. He failed to see that this would in any way be called "fleecing" the consumer, as Alderman Miles put it. They simply were required to pay in accordance with the registration of a meter which had been stamped and certified in the usual way; and this was a means of getting them to do so. With regard to including the cost of services in the estimate, he had made a comparison between the cost of connecting up an ordinary 3-light consumer and one on the prepayment system. In both cases he had included the cost of services; so that they were on the same basis. Referring to the employment of contractors, Mr. Carr had really replied to that question. Their contractor happened to be formerly one of their inspectors; and the work was let out to him according to the agreement set out in the paper. This system was adopted by the largest Gas Company in the world, and by many others; and they found it better to engage one man, and to know definitely how much the work was going to cost, than let their own inspectors keep a check upon him. It had been suggested to him (Mr. Dougall) that the consumers, if they would take the trouble, could always check the meter by reading the index; but it was pretty well known that they would not take this trouble. They did not do so in the ordinary case; and he was afraid the new class of consumers which these meters introduced would not do so either. With reference to the difficulty of getting cooks to carry on homely lessons, he looked upon this departure as a means of providing new employment for women. Many cooks, of course, got married; and some of these had afterwards to seek employment to add to the income of the family. Why should they not work in this way, instead of going out charing or doing other work of the kind?

The Purification of River Water.—In 1894, the Paris Municipality called for competitive schemes for the purification of river water intended for drinking purposes, and appointed a Commission to investigate the different plans sent in. Of the 148 schemes submitted, the majority were wild or amateurish; but some 29 proposals were considered worthy of further consideration. Of these, four were based on the action of heat, 12 on mechanical treatment or filtration, six on chemical treatment, and seven provided for a mixed treatment. On experimenting, the Commission concluded that the processes based on the action of heat were costly; the working expenses ranging in the different cases from 9d. to 4s. 4d. per 1000 gallons. The mechanical methods necessitated frequent cleaning; porcelain filters and sand filters giving the best results. The purely chemical methods, on the other hand, are said to have been impracticable; so that finally the Commission recommend a combined treatment—the addition of chemicals being followed by sand filtration. With such a process, says the "Engineer," they have obtained an output of nearly 1000 gallons per day from 11 square feet of sand filter; the organic matter being reduced 30 per cent. and the bacteria 99·77 per cent. There was, however, considerable irregularity in the working.

Differential Charges for Gas.—Our readers may remember that, at the meeting of The Gas Institute in 1894, Mr. George Anderson read a paper on the above subject, in which he gave some particulars of the system he has introduced of making a reduction in the charge for all gas consumed in excess of the quantity burnt in the previous corresponding quarter. As the subject of differential rates came up in the discussion on Mr. Holliday's paper at the recent meeting of the Institute, as will be found from our report in another part of the "JOURNAL," it may be of interest to give some figures showing the results of Mr. Anderson's system. In the towns named, the price of gas ranges from 3s. 4d. to 5s. per 1000 cubic feet. The system was introduced at Waterford in March, 1890; and in May last, out of 1103 meters fixed, 357 were used for low-priced supplies—being 32·3 per cent. of the consumers. In June, 1892, it was tried at Fermoy; and up to last month, 54·7 per cent. of the consumers had adopted it. Six months later, Tipperary took it up; and now 48·7 per cent. of the consumers are availing themselves of it. In February, 1893, it was introduced at Kilkenny; and in the following month the West Kent Gas Company adopted it. In Kilkenny there are now 51·2 per cent. of the consumers using low-priced gas; and in the district of the West Kent Gas Company, 34·8 per cent. The latest place to adopt it was Caterham, in April last. Here there are 247 meters fixed; but 137 are used for low-priced gas, which is taken by 55·4 per cent. of the consumers. The gas may be used for any purpose; and, of course, no second meter or service-pipe is required.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1414.)

THE counter attractions of sport have again powerfully handicapped business; and Ascot last week had a greater effect in this way than Epsom a fortnight ago. With this, and with the fine hot weather generally, the attendance in the Stock Markets was much reduced. Almost every market was dull, though Americans were an exception; the last move in regard to gold on the political chessboard having been a good one. Prices accordingly are lower all round, except in the last-mentioned quarter; and African ventures were particularly depressed by Dr. Leyds' telegrams. The week, therefore, has been generally a dull and flat period. In the Money Market rates were very poor; the superabundance of money being noticeable. Business in the Gas Market suffered like the rest from the prevailing quietude, but with the important difference that, while they were depressed, all Gas issues of every description dealt in were very firm indeed. Several quotations, embracing widely varying undertakings, made considerable improvement; and nothing *per contra* went the other way. The bulk of the business was done in Gaslight "A," which has lately been oscillating a couple of points up and down. Last week it rose, changing hands on the opening day at 310½, but advancing on Friday to the best figure of the week—314¾. Transactions in the secured issues were few; but they readily commanded high prices. In South Metropolitans, there was nothing much to note; business being rather quiet at the old figures. Nothing at all was recorded in Commercials. The Suburban and Provincial group had hardly a transaction; but quotations show further considerable advances. While little of this class of undertaking comes into the market, it seems to be an especial favourite at the Auction Mart, where it certainly appears to realize prices which are sometimes much higher than those which show in the Official List. A considerable parcel of Crystal Palace was sold there on Monday; and in result the official price has gone up five points. Brentford also is still on its upward course. There was not much doing in Continentals; and Imperial were about steady. But Union and European had a further rise. The other improvements noted on the list were scored by the Argentine Companies. Water was quiet; and dealings were mostly in debenture issues. Movements were slight and irregular; consisting of a rise in Kent and a fall in East London.

The daily operations were: The Gas Market was very quiet on the opening day, and prices were not remarkable; but Crystal Palace rose 5, and Belgrano and Buenos Ayres ¼ each. In Water, Kent was 1 higher. There was a shade more activity on Tuesday; and prices were a little better. Continental Union advanced 2; and Buenos Ayres, ¼. East London Water fell 2. Transactions on Wednesday were at about the same level; and quotations did not move. Thursday was a very quiet day; but things were on the rise. Gaslight "A" advanced 2; and European, ½. Buenos Ayres was put back ¼, although business was actually marked above top price. Friday was noticeable for good firm prices; but quotations did not move. Saturday was much the same as usual; and the only change was a further rise of 2 in Brentford old.

ELECTRIC LIGHTING MEMORANDA.

The Meeting of the Municipal Electrical Association—Mr. Wright on Municipal Problems—Municipal Improvidence—The Dry-Nursing of Municipal Electric Lighting Ventures.

THERE has just been held in London, at the Royal United Service Institution, a meeting a new society called the Municipal Electrical Association. It is composed of officers of the electricity supply departments of local authorities in the United Kingdom; and those who were responsible for the programme of the first meeting seem to have laid themselves out to secure novelty at any cost. Thus they called their gathering by the American term "convention." And as to this a technical contemporary patronizingly remarks, that "to one who has had some years' experience of the debilitating effects of British Association meetings, there was something refreshing in the suggestion." We are rather inclined to agree with a different estimate of title, that it smacks of that grandiloquence over essentially small matters which is usually supposed to be as American as the "Monroe doctrine," and is similarly abandoned to Transatlantic use. Next thing, perhaps, the Municipal electricians will try their hands at organizing an exhibition of municipal electrical engineering and call it an "exposition." This would be very American, and, of course, progressive in the highest degree.

The first President of the new Association was Mr. Arthur Wright, of Brighton, who has attained some fame as the deviser of a method of charging for electricity supplies which is supposed to bring in a large revenue without the consumers feeling that electric light is dearer than gas. Mr. Wright's presidential address was published in the "Electrician" of Friday last, and is indulgently criticized by this and other technical journals. The author had the great advantage of being the first in a new field; and so he was able to run over a number of debatable points

connected with the supply of electricity by municipalities which have not before been discussed in the same way. He divided some of the problems that have already confronted the management of municipal electricity supply undertakings into the three classifications of questions of policy, commerce, and technics. The first group includes the questions of the proper period to be allowed for the repayment of loans, and of the allocation of profits. Upon the latter subject, Mr. Wright had something to say that sounds painfully familiar to students of the ways of trading local authorities. We gather from him that the weakness for making a profit to be applied in the apparent reduction of the rates, so common among municipal Gas Committees, equally attaches to municipal Electric Light Committees, and is the more obnoxious to the responsible officials in the degree in which they experience the difficulty of clearing a profit by the distribution of electricity at anything like a popular figure.

It is satisfactory to know that the independent authority of the "Electrician" is on the side of the view that before the rates are relieved by annual doles, it would be better to make ample provision for all contingencies affecting capital. "The prosperity of a particular town is a precarious asset at the best; and the smaller its indebtedness when the 'slump' begins, the better." This is expressing strongly, if crudely, an idea that seems hardly ever to occur to those who are responsible for the finances of our towns. These sanguine gentlemen, who get elected upon local authorities upon all sorts of pretensions, very rarely seem to reflect upon the past or the future of their towns, in connection with local financial responsibilities. Yet of considerably the greater number of the towns in the United Kingdom which have undertaken their own gas and electricity supply, it might be shown that their present standing is almost an effect of accident, and possesses no sort of guarantee of permanence. They are manufacturing centres, which may at any time have to yield their pre-eminence to more favourably situated rivals. Fifty—even thirty years ago, many of them were mere hamlets; and as many years hence the grass may be growing in their deserted suburban streets, and the factories upon which they depend may be crumbling ruins. Yet at the present day local authorities go on piling up debt as though the district could never know a reverse; and if they make a show of keeping down the rates by working gas and electricity supply at a profit, they think themselves wise as well as fortunate.

Another topic touched upon by Mr. Wright is of peculiar interest to municipal gas engineers. He spoke of the practice of some local authorities in putting the electricity supply under the control of the gas committee; and he hinted that "inevitably slow progress" is the result of this policy. "In some towns, human nature seems to be so overrated that their corporations have made one manager responsible for these two competitive departments." This is one way of putting it; but Mr. Wright is in error in regarding the two branches of the artificial lighting business as necessarily competitive, when they are in the same hands. We should be very glad indeed if local authorities could come to some reasonable and uniform understanding as to the relations that ought to exist between their gas and electric lighting undertakings; but it is quite a mistake to suppose, as Mr. Wright does, that the latter enterprise suffers from being associated with the former, either in regard to municipal administration or management. Indeed, it is notoriously otherwise. The electric lighting, being the youngest-born, is always favoured at the expense of the gas undertaking. Often it gets its manufacturing site for nothing, its fuel for little more, and its management and book-keeping free. Electricity supplied for public lighting and to public buildings is paid for; while gas is often supplied for all such purposes without charge. It is frequently only this municipal support of a central electric lighting station that enables what looks like prosperity to be shown on the accounts; while gas subsidizes all, and stops the leaks of every municipal bucket. Speaking upon Mr. Wright's address, Alderman Higginbottom, of Manchester, observed that the Corporation Electric Light Committee had not touched street lighting—for a very good and sufficient reason. The Gas Department supplies this service gratis. Where would be the profit of the Electric Light Department if they did likewise? In many towns, on the other hand, it is considered the thing to make the public lighting the mainstay of the electrical department. Manchester does not find such an expedient necessary; but the Corporation know better than to take the street lighting out of the domain of the Gas Committee.

Powdered Coal for Firing Steam-Boilers.—At the recent meeting of the Institution of Mining Engineers, Mr. Bryan Donkin contributed a communication upon "Powdered Coal for Firing Steam Boilers by the Wegener and other Systems." Among the advantages of using powdered coal firing as compared with large coal, he stated to be the absence of smoke after the fire-brick lining had become hot, continuous and automatic fuel supply, less dependence upon the stoker, more perfect combustion, more easy regulation of the exact quantity of air required and of steam generated, saving in cost of labour, economy of coal, no grate or grate-bars, no fire-doors, higher furnace temperatures, and increase of boiler efficiency from 15 to 25 per cent. Among the disadvantages were the cost of grinding the coal, which would vary according to the difference of locality and quantities ground, but might be taken from 9d. to 1s. a ton, and repairs to the fire-brick lining.

PRESENTATION TO DR. AUER VON WELSBACH.

An interesting social function took place last Friday, when the various incandescent gas-light companies of the world, in conjunction with some business friends, gave a banquet at the Savoy Hotel to Dr. Carl Auer Ritter von Welsbach, and presented him with an illuminated address and service of plate, in recognition of his high merits as a chemist and inventor, as manifested by the epoch-making achievement which has immortalized his name in the annals of gas-lighting. Nearly a hundred gentlemen, many of eminence in the world of science and the arts, assembled to do honour to Dr. Auer, who came to London from Vienna for the occasion; and letters of apology were received from others—including Lord Rayleigh, Sir F. Abel, and Professor Dewar—who were prevented from attending by the coincidence of the Kelvin Jubilee celebration in Glasgow. Mr. J. Fletcher Moulton, Q.C., presided at the dinner, and made the presentation to the guest of the evening in a felicitous speech in which he laid stress on Dr. Auer's claim to rank among those rare individuals to whom it has been given to change the industrial history of the world, in an important department, by their personal attainments and power of applying exceptional knowledge to positive purposes. Dr. Auer responded in German; speaking with modest diffidence of his own part in bringing out the incandescent gas-light, and making graceful acknowledgment of the painstaking labours of those who, like Mr. Julius Moeller, have worked with and after him to perfect the invention. Unhappily, Mr. Moeller was prevented from being present by a painful illness, which confines him to his bed. The service of plate is a unique work of art, comprising a centre piece, two side pieces, and six dessert stands of oxidized silver, finely chased by Vechte, with eight small pieces, and a dozen beautifully-made dessert knives, forks, and spoons. The dessert plates are twelve of the largest and choicest New Guinea mother-of-pearl shells. The whole *suite* was supplied by Streeter and Co., Limited, and does infinite credit to the taste of those who made the selection. Mr. L. de Fonblanque, the Secretary of the Incandescent Gas-Light Company, Limited, organized the demonstration in Dr. Auer's honour, and made all the arrangements on a scale and with a completeness which rendered the occasion a memorable one for the representative company who had the good fortune of meeting in the flesh one of the most retiring, as well as one of the greatest and most successful, inventors of the age.

THE ALKALI, &c., WORKS ACT—THE CHIEF INSPECTOR'S REPORT.

The Thirty-second Annual Report of the Chief Inspector, on the proceedings during the year 1895 under the Alkali, &c., Works Regulation Acts, has just been issued. This is the first report signed by the new Chief Inspector, Dr. R. Forbes Carpenter, the successor of Mr. A. E. Fletcher, who retired in May of last year after thirty-one years of unremitting work. It begins by making a deserved acknowledgment of the value of Mr. Fletcher's eminent services to the State, not the least of which was his part in the inception of the Act of 1892, which brought many additional processes of manufacture, where acids or noxious gases and vapours are evolved, under the skilled supervision of the Local Government Board's Inspectors.

The number of works now registered in England, Ireland, and Wales is 1065, besides 126 works registered in Scotland. These numbers show a decrease of one alkali works, and an increase of ten other works since 1894. These numbers do not, however, give the amount of work devolving upon the inspectors, inasmuch as several scheduled processes are often carried on in one works, all requiring detailed attention and examination. Since the standard of efficiency defining the best practicable means of attaining satisfactory working is not fixed for other than alkali and sulphuric acid works, the course of inspection is constantly tending towards the improvement of working results—a circumstance which might easily be productive of friction between manufacturers and inspectors, but for the existence of a sense of duty on both sides.

It is interesting to note that the weight of salt decomposed by alkali works using the old Leblanc process exhibits a further decline; and, for the first time, this weight is exceeded by that required for the ammonia-soda process. Reference is made in the report to the new electro-chemical alkali processes now coming into use; and a description is given of the Hargreaves and Bird electrolytic process worked out experimentally at Farnworth, near Widnes, in which a gas-engine is employed to drive the dynamo, and the carbonic acid of the gas-engine exhaust also plays an important economical part. No notable improvement is reported in the working of the Chance-Claus sulphur-recovery process; the Inspector remarking that "the problem of how to turn to account the 10 to 15 per cent. still lost as sulphur, and escaping from the process in gaseous fumes and in the finely-divided state of sulphur flowers, is no step nearer solution. It is beset with great difficulties, and has hitherto baffled the ingenuity of the many practical minds that have studied it." It is stated that the Oldbury Alkali Company, where Mr. Chance first developed his process, are still engaged in the manufacture of cement from the slurry

finally leaving the chambers; and they claim to be able to satisfy the requirements of engineers in regard to test. The curious observation is made that while the air of Widnes continues to show an undue proportion of sulphuretted hydrogen, contributed from a variety of sources not always traceable, the district still exhibits a lower death-rate than Liverpool.

Proof is given of the magnitude which the chemical manure industry has attained in this country. The home production of superphosphates is nearly a million tons per annum. Taking the production of other countries into account, the yield amounts to about 4 million tons yearly, of the total value of £10,000,000 sterling. "In addition to that, nitrates were used to the value of £8,000,000, ammonia to the value of £2,500,000, and other chemical fertilizers—such as potash salts, guano, bone meal, slag phosphate meal—to the value of £2,000,000; making an approximate total expenditure annually, in chemical products for restoring the land, of between £22,000,000 and £23,000,000 sterling. It is certain, also, that the limits of possible consumption have by no means been reached, and that further increase of manufactured manures is to be confidently looked for in the future."

This part of the report leads up to the section dealing with sulphate of ammonia works, which commences with a reference to what was stated in the last report respecting the various means in use for dealing with the sulphuretted hydrogen evolved by the distillation of gas liquor. Stress was herein laid upon the consideration that, with the progress of chemical technology, several of these methods were to be classed as among "the best practicable means" enjoined for rendering this gas innocuous. "The methods for large works, or any works possessing vitriol chambers, (1) of conversion first into sulphurous acid, and finally into sulphuric acid in vitriol manufacture; and (2) in large works, where this opportunity does not occur, of conversion into sulphur by the Claus kiln, are in frequent use." The method of absorption in oxide of iron is more generally used where the annual make of sulphate does not exceed 300 tons. "Considerable pressure has had to be brought to bear upon the owners of several works who have been unwilling to abandon the method of burning the gas; but only in works of the smallest type can this conversion into sulphurous acid and discharge of the latter into the atmosphere be recognized as admissible, now that other methods have been proved by prolonged use to yield satisfactory results."

The report states also that the increasing substitution of the continuous method of sulphate manufacture for that of the intermittent type is found to result in considerable economy of fuel, and to render the problem of dealing with the foul gases very much easier of solution. "Naturally, the advances made in the more populous manufacturing centres of this industry in the North and the Midlands take time to spread among the more isolated works in the southern parts of the country, where opportunities do not exist to the same extent of becoming acquainted with the improved results in working which have for a long time been obtained without difficulty in the larger centres. The inspectors have done much to dissipate ignorance and prejudice; but occasionally it has been necessary to put strong pressure before promise of amelioration could be obtained." This is very unpleasant reading, if the remarks of the Chief Inspector apply, as they are probably meant to do, to certain gas managers in the South who have given trouble in this regard. The technical societies and journals can be of small use to those sulphate makers to whom the report thus imputes "ignorance and prejudice;" and it is to be hoped that this is the last time such a reproach will appear in an official publication. If a few gas managers have been reactionary, however, others have notably helped the inspectors in the direction of working out sulphuretted hydrogen purification by means of oxide of iron, in conjunction with revivification of the material *in situ*. The report notes that where this is done by intermittent downward draught of air, in the reverse direction to that taken by the foul gases, care needs to be exercised in watching the heat of the air passing to the chimney, so as to check the draught if any marked or rapid increase of temperature takes place, which might develop local heat to the point of firing the mass and charring the grids. For this reason, the plan has been adopted of changing the current of the gases every six hours, so that there is less revivification to be done at a spell; thus diminishing the quantity of heat that may be developed in a given time and area. This precaution has been found sufficient to prevent firing or charring of the grids. An analysis is given of a sample of spent oxide taken from the under layer of a box when finally emptied; the proportion of sulphur soluble in carbon bisulphide being 73·90 per cent., and very little sulphur being oxidized to sulphate, and thus rendered unavailable.

Mr. Dexter's improvement of inducing revivification *in situ* by introducing air and moisture in due proportions with the foul gases, is favourably mentioned in the report. This method, originally proposed in connection with coal gas purification, has been adapted at the Luton Gas-Works to sulphate plant; and the report gives analyses of spent material so treated. It appears also that the Chief Inspector attaches considerable value to an experiment carried out in a French gas-works by MM. Delseaux and Renard with the object of testing the efficacy of Mr. Dexter's steam and air process of coal gas purification by oxide. The analyses of the result of this test are very characteristic. It is noted that in the Dexter method, as compared with that of simple air admission without vapour of water, more of the sulphur combines with the iron, probably as bisulphide, and escapes estimation in the bisulphide of carbon test. The material had an increased efficiency in gas purification in the ratio of 12·25 : 20·5 million cubic feet purified.*

The news of the melancholy accident at the Tynemouth Gas Company's works reached the Chief Inspector while he was engaged in the preparation of his report. The occurrence is briefly described in the report of the District Inspector, Mr. Bernard E. Smith; and Dr. Carpenter observes that "the reliance on valves of ordinary construction for shutting off access of foul gas to disused purifiers is clearly attended with great risk." He accordingly gives, for the information of those interested, a drawing of a "change water-lute" of the type in use for many years past at numerous sulphate works. The arrangement shown is intended also for aëration of the purifier before emptying, or for use in revivification of the oxide *in situ*. It is remarked that this aëration previous to emptying a recently detached purifier is absolutely necessary in purifiers of 5 feet depth and upwards, if safety is to be ensured; and it is desirable even in purifiers of shallow depth.

Emphasis is laid on the necessity, in designing sulphate plant, for providing for the drawing off of the water condensed from the vapours leaving the saturator *at the hottest possible point* in this portion of the plant. Notwithstanding the attention directed to this matter in previous reports, makers of this kind of apparatus appear to have overlooked its importance. If this fluid is mixed with the fresh gas liquor pumped into the still, the point becomes immaterial.

Last year the production of sulphate of ammonia in the United Kingdom attained the total of 179,651 tons, of which gas liquor yielded 119,645 tons. The remainder came from iron-works, shale-works, and producer gas, coke, and carbonizing works. Even at the unprecedentedly low prices that have prevailed, this material represents an addition to the national wealth of more than £1,500,000 for the year. "The methods of removal of ammonia from illuminating gas in gas manufacture become more perfect year by year with the progress of engineering, and the closer chemical supervision of plant; but the great part of the increase in the first item is due to the absolutely larger amount of coal carbonized in gas-works."

It is interesting to note that the application of sulphate-recovery plant to blast-furnaces incidentally results in a considerable saving of fuel. Consequently, the erection of new plants of the kind is constantly going on, notwithstanding the low value of the product. Mention is made in the report of the increase in the number of coking plants having residual-recovery attachments; and the Mond producer system is favourably referred to. The application of sulphate of ammonia as a fertilizer receives attention from Dr. Carpenter; and the desirability of encouraging the cultivation in the United Kingdom of the sugar-beet, and potatoes for glucose manufacture, is discussed very briefly. The new Chief Inspector has very little to say respecting the nuisance of black smoke.

Several of the District Inspectors' reports afford interesting reading. Mr. Smith's references to the Tynemouth Gas-Works catastrophe have already been mentioned. He appears to think that appliances should be kept at gas-works for men to use on entering a dangerous atmosphere; and he promises next year to describe an improved mask and respirator suitable for the purpose. Mr. Affleck's observations upon the state of the atmosphere of Widnes are worth reading. In Mr. Jackson's report the new saturator designed by Mr. Alfred Colson, of Leicester, is described and illustrated. This is a vessel with a conical bottom, into which the salt gravitates, to be released from time to time by opening a simple valve. It appears to be similar to the appliance used for the same purpose by Mr. Green at Preston, which was described in the JOURNAL for Nov. 5 last. Dr. Fryer also describes something of the kind designed by Mr. C. Stafford Ellery, and in use at the Bath Gas-Works. Mr. F. Napier Sutton's report is full of interesting detail. The Scotch practice is specially reported upon to the Secretary for Scotland; the most important point in connection with it being the statement that the amount of ammonia recovered in the distillation of shale and from blast-furnaces is large and continually increasing. The Kessler vitriol-rectifying plant introduced into this country last year is duly noticed and discussed. The fumes of a coke-furnace are the working agency in this process. Of course, the report will be in the hands of every gas manager in the kingdom who works up his own ammoniacal liquor, for which reason it is unnecessary to go more fully into its contents here.

The Proposed Research Laboratory at the Royal Institution.—At the second *conversazione* of the Royal Society, which took place on the 10th inst., one of the finest exhibits was that shown by Mr. R. L. Mond, consisting of the apparatus intended for the Davy-Faraday Research Laboratory at the Royal Institution. It is considered to be perhaps the most magnificent set of physical apparatus in the world.

* The experiment referred to was described in a paper for which the authors were awarded a prize of 750 frs. by the Société Technique du Gaz en France. (See "JOURNAL," Vol. LXVI., pp. 977, 1343.)

NOTES.

Fresh American Oil-Fields.

Rumours of the approaching exhaustion of the American petroleum supply have been sufficiently persistent to lend interest to the report that there has recently been a marked development of the oil-fields of Kentucky. It is stated that operations in this field have been already so extended as to induce a general belief in America that the southern section of this State will develop an oil-field capable of rivalling the northern portion in its palmiest days. It is also asserted that two-thirds of the big State of Tennessee is a magnificent oil-yielding region. The oil-belt of this State is merely the southern end of the Pennsylvania, West Virginia, Ohio, and Kentucky oil-fields; and 95,000 acres of it are stated to have been acquired by the Standard Oil Company. The Company now stand the reputed owners of 700,000 acres of land in their own right, besides leasing a million acres of oil land; and they are reported to be on the point of spending a million dollars on the construction of a new pipe-line, with the object of placing upon the market the produce of their new territory. Oil stocks in the whole Appalachian region are also stated to have largely increased of late. If all this means that the Standard Oil Company are never again going to take advantage of an alleged "shortage" of the oil supply to advance prices against their customers, the news will be regarded as good by consumers of petroleum.

Organic and Combustible Matter.

Lecturing at the Royal Institution, Dr. G. O. Poore described the circulation of organic matter. Without attempting to define this term, he stated generally that all organic matter is combustible; and all our combustibles are of organic origin. He made the comparison between the combustion of fuel in a furnace and that of food in the body of an animal; pointing out that whereas in the furnace the fuel is used up and the furnace wears out, in the animal there is increase of size, while the residuum stimulates the soil to an increased production of food-stuff. Hence the animal is the true regenerative furnace, causing increase of its own fuel at the expense of the sea on the one hand and the atmosphere on the other. It is impossible to imagine an increase in one direction without a corresponding decrease in another. When organic matter collects under water, fermentations are set up; and the organic matter is reduced instead of being oxidized. The tendency of organic matter when thus treated to form combustible bodies is very remarkable. The inflammable gases sometimes formed in cesspools and the marsh gas evolved by mud in ponds and rivers are familiar examples, as are also the alcohols formed by the fermentation of carbohydrates. Our immense stores of coal and peat are due to the silting up of marsh plants in past ages and more recent times; and Dr. Poore thinks there is no doubt that the so-called mineral oils are of organic origin, as are also the nitrates that are so largely used in the manufacture of explosives. In short, if we are to judge the past by the present, it is impossible not to come to the conclusion that life must have preceded combustion in this world. This biological theory of the cosmogony makes the world subject, like all other things, to the processes of development, evolution, and decay; and Dr. Poore believes that such a theory has fewer drawbacks than might at first sight appear. Organic matter, in brief, is the world's capital; and the more frequently we can make it circulate, the greater will be our increase of material wealth. If we burn it, or throw it into the sea, we thereby spend money and dissipate our capital; but if we can get it on to the land, we thereby increase our capital, and earn frequent dividends.

The Conductivity of Boiler Scale.

Some instructive experiments on the conductivity of boiler scale have been made by a Committee of American steam engineers, in consequence of what passed at a recent meeting, at which it was stated that instances were known of cases of boilers incrusted with scale to a thickness of a quarter of an inch without their economy suffering appreciably. In many text-books of steam engineering, statements can be found to the effect that scale $\frac{1}{16}$ inch thick will cause a loss of 15 per cent. of fuel and so on. Consequently, it was determined to try experimentally the best conducting power of various materials entering into the composition of boilers, including scale collected from old boiler-plates, in order to ascertain the connection that exists between the conductivities of these materials and the steaming capacities of boilers in which they form component parts. The method of making the tests was that of preparing flat samples of the different materials cut to a uniform size, and carrying on their upper surfaces short pieces of wire stuck on by means of wax at an angle of 45°. Upon being heated simultaneously over a vessel of water kept boiling by means of a gas-burner, the various rates of conducting of the samples were exhibited by the different periods of time that elapsed before the wax upon them melted sufficiently to allow the indicator wires to fall. It was a rough test; but it seemed to correspond with natural usage of the materials. The pieces of wire dropped upon the test pieces in the following order: Brass, 5 seconds; iron, 9 seconds; plaster of paris, 35 seconds; portland cement, 63 seconds; boiler scale, 35 seconds. The experiments are recorded for what they are worth; but evidently great care would be necessary to give them any true comparative value.

Monazite and Granitic Rocks.

In an article on "Minor Minerals of the United States," published in the "Engineering Magazine," Mr. David Day remarks that a few years ago monazite might have been included in the list of minerals for which there is practically no market. It now furnishes a good example of how considerable deposits of what was an extremely rare mineral can readily be obtained, if a demand for it is fairly well advertised. Although this mineral has been known to occur in many places in granite rocks, and has been noticed in more than a dozen localities in the United States, besides the present sources of supply, it was one of the very rare mineral curiosities when Professor W. E. Hidden observed its occurrence in considerable quantities in Burke and M'Dowell counties, North Carolina, in 1879. As soon as an economic value was established for it on account of the incandescing qualities of the oxides of the rare earths which it contains, it became a commercial article. It is the thoria in it which renders it valuable for the purpose of being used in the manufacture of incandescent gas-light mantles; and this constituent is present in largely varying proportions—being rather of the nature of an impurity in the monazite, which is principally a phosphate of cerium. It is curious to observe that a number of geologists now put forward the theory that monazite can be found in any granitic rock—in fact, that its presence is a fairly good test as to whether or not a rock is granitic.

COMMUNICATED ARTICLE.

ON THE ESTIMATION OF SULPHURETTED HYDROGEN AND CARBONIC ACID IN GAS LIQUOR.

By H. Leicester Greville, F.I.C., F.C.S., &c.,
Chemist to the Commercial Gas Company.

Many years ago, when contributing articles to "King's Treatise on Coal Gas," I published a simple and expeditious method of determining the proportion of sulphuretted hydrogen in gas liquor, depending on the use of an ammoniacal solution of copper sulphate of definite strength. I have always employed this method with satisfactory results; but experience has suggested one or two modifications of more or less importance, which may possibly justify my republishing the details of the process.

There is no doubt that the elimination of ammonia from coal gas has a most important bearing in the removal of impurities. This fact has always been recognized; but it is accentuated in more modern years, by several factors. One is the increasing tendency to separate the whole of the ammonia from the gas, as a sequence of the rapid development of sulphate manufacture in gas-works. Another factor is the greater efficiency of modern scrubbers, and more especially of modern washers, over similar appliances of an older type—ensuring a more intimate contact of the liquor with the gas, and therefore enabling the ammonia to extract the maximum percentage of impurities. How much is saved to an average gas company in the domain of such solid expenses of purification as expenditure on lime and oxide, by the employment of efficient washing and scrubbing appliances, is in many cases not sufficiently appreciated. If it were otherwise, we should find more attention given to these details, and possibly more capital expenditure on efficient machinery. If gas liquor, as is generally admitted, is of such great use for purposes of purification, simple means of ascertaining the actual amount of duty which it is performing must have a distinct and intrinsic value.

Dealing with the general estimation of sulphuretted hydrogen and carbonic acid, I have always found it most convenient to formulate results in grains in preference to grams, more especially as the former are more readily calculable; in the case of the liquid taken for analysis, into gallons; and the gases estimated, into cubic inches or cubic feet. This method of expression is more intelligible to the average gas manager for practical purposes. It may possibly seem (using a somewhat vulgar vernacular) a mongrel plan, to employ a combination of the gram and the grain system; but with regard to the estimation of impurities in gas liquor, I have pursued this course for some considerable time.

The cubic centimetre burettes furnished with glass stopcocks so much used for general laboratory purposes, are so neatly graduated, and have generally such artistic merit, that they seem to exercise (to me, at least, as a devotee of science) a special attraction. I have, as a consequence, for many years abandoned the use of the old-fashioned Bink's burette, with its subdivisions of ounces for the estimation of the strength of gas liquor, and substituted the cubic centimetre burette. The transition is simple. Taking one volume of liquor, neutralized by an equal volume of 10 per cent. of sulphuric acid, divided into 16 parts, each part is equal to 1 oz. (so called) strength. I have had specially made small graduated flasks, holding 64 c.c., as a measure of the liquor to be tested. Working with this

measure, and a 50 c.c. burette, charged with standard 10 per cent. acid, 4 c.c. of acid equals 1 oz. strength; and each cubic centimetre therefore equals ¼ oz. As each cubic centimetre is divided into tenths, and with methyl orange as an indicator, *versus* the old system of employing litmus paper, a degree of accuracy can be obtained far in excess of that attainable under the older system.

Turning from this digression to the main object of the present article, and taking the question of the determination of sulphuretted hydrogen first, I prefer to prepare my standard copper solution from metallic copper, in preference to employing cupric sulphate as previously recommended. A convenient strength for ordinary work may be prepared as follows: Take 46·7 grains of clean metallic copper, in the form of thin foil or wire, and dissolve in a slight excess of nitric acid; being careful to prevent loss from spurting. When the metal is entirely dissolved, dilute with a small quantity of water, and add such an excess of liquid ammonia that the precipitate at first formed is perfectly dissolved with the formation of a clear blue solution. Then dilute with distilled water, until the volume is half a litre (500 cubic centimetre). This will give a solution of which each cubic centimetre equals 0·05 grain of sulphuretted hydrogen.

The *modus operandi* is then as follows: A 25 cubic centimetre burette is filled with the standard copper solution. Then 100 grains measure of the liquor to be tested is carefully measured, into a white porcelain basin, diluting with a little distilled water, and adding a small proportion of strong ammonia. Now run in the copper solution at first drop by drop, stirring vigorously, and noting the first appearance of a slight brown tint. Record how much copper solution has been used up to this point; and then run in more boldly, still stirring constantly. The solution will remain brown and turbid until the critical point is reached, when black copper sulphide will separate in heavy particles and rapidly settle down, leaving a colourless supernatent liquid. If too much copper solution has been added, the supernatent liquid will have a slight blue tint, and a second test should be made; but with a little experience in manipulation, this will be found unnecessary in ordinary cases.

I have made experiments as to possible errors arising from such normal constituents of gas liquors as sulphocyanides, hyposulphates, and cyanides. The two former have no effect; but the presence of cyanides certainly does influence the test. This source of error is, however, practically remedied by deducting from the total volume of the copper solution used the amount necessary to produce the first slight brown coloration, and calculating the proportion of H_2S on the difference. The percentage of H_2S in the sample is, of course, obtained (with 100 grains of liquor) by multiplying the number of cubic centimetres of solution used by 0·05. As an example, 100 grains measure of a sample of scrubber liquor, required a total of 6·6 of copper solution; but 0·8 was needed before the first indication of a brown coloration. The amount of copper solution, therefore to be credited to H_2S was 5·8, and $5·8 \times ·05 = 0·29$ of H_2S per cent. This sample gave, by the ordinary precipitation process by arsenic solution, and weighing as As_2S_3, 0·28 per cent. of H_2S.

Adopting the same lines of procedure with other samples, the following results were obtained:—

	H_2S by Volumetric Process.		H_2S by Precipitation as As_2S_3.
Condenser liquor	1·180	..	1·200
Scrubber	0·470	..	0·450
Do., check test	0·475	..	0·450
Scrubber	0·680	..	0·690
Condenser	0·410	..	0·390
Unnamed	0·107	..	0·106
Well liquor	0·607	..	0·600
Weak scrubber liquor	0·081	..	0·079

The test can be made in a few minutes.

With regard to the estimation of carbonic acid, the method of testing is almost as simple as that for sulphuretted hydrogen. The only accurate test solution necessary is the ordinary 10 per cent. acid in use for the estimation of the strength of gas liquors. Beyond this, all that is required is a solution of ordinary calcium chloride, of an approximate strength of about 9 per cent. This may be easily prepared by dissolving half a pound of ordinary dry calcium chloride in some distilled water in a flask, and, as the solution is generally faintly alkaline, adding carefully some very dilute hydrochloric acid, until the liquid gives a neutral reaction. Dilute then to the volume of half a gallon, and filter into an ordinary Winchester quart.

The process depends on the fact that, whereas the ordinary 10 per cent. acid is an indicator of all compounds of ammonia in gas liquor capable of being decomposed by its action, the addition to the liquor of an excess of calcium chloride decomposes the ammonium carbonate present, precipitating calcium carbonate, and fixing the ammonia previously in combination with CO_2 as neutral ammonium chloride. The precipitated calcium carbonate being removed by filtration, the alkalinity of the filtrate is determined with 10 per cent. acid; and the loss of alkalinity is a measure of the proportion of CO_2 present. The reaction which occurs may be expressed thus:

$$(NH_4)_2\,CO_3 + CaCl2 = CaCO_3 + 2NH_4\,Cl$$

The mode of procedure is as follows: Take, say, 1000 grains measure of the liquor to be tested, pour into a white porcelain basin, and (using methyl orange as an indicator) find how many cubic centimetres of 10 per cent. acid are required for neutralization. Having noted this, measure 2000 grains of the liquor into a stoppered decigallon measure, and add 2000 grains measure of the calcium chloride solution. Shake vigorously at intervals; and, after a brief period, the calcium carbonate will settle rapidly down as a dense precipitate. Pour the comparatively clear liquid on to a dry filter paper, filtering into a graduated measure; and when 2000 grains measure have been obtained, pour this amount into a white porcelain basin, and determine the alkalinity with 10 per cent. acid as before.

The calculation is then simple. Sulphuric and carbonic acids are both what is termed "dibasic;" replacing equivalent proportions of the same alkali in combination. The molecular weight of H_2SO_4 being 98, and that of CO_2 being 44, these figures represent the equivalency of the two acids with regard to the same base. With standard H_2SO_4 of 10 per cent. strength, 1 c.c. of 15·433 grains would contain 1·5433 grains of H_2SO_4—equal to 0·693 grains of CO_2. As an example, say that 1000 grains of the raw liquor required 40 c.c. of 10 per cent. acid for neutralization, and an equal quantity (1000 grains) of the filtered liquor, after treatment with $CaCl_2$, required for neutralization 20 c.c. of test acid. Then $40 - 20 = 20$ c.c. difference; and $0·693 \times 20 = 13·86$ of CO_2, equal to 1·386 per cent.

The following experiments demonstrate the accuracy of the process. The figures, showing determination by weight in comparison to the volumetric method, were made by washing and weighing the precipitated calcium carbonate, and then calculating the CO_2.

	CO_2 per cent. Volumetric Process.		CO_2 per cent. Gravimetric Process.
Condenser liquor	2·020	..	1·950
Scrubber "	1·800	..	1·840
" "	0·664	..	0·677
" "	0·680	..	0·690
Unnamed "	0·977	..	0·951
Surface condenser	0·762	..	0·763
Well liquor	1·630	..	1·640
Scrubber	0·069	..	0·074

The determinations of H_2S and CO_2 can be made easily in 15 minutes; the proportion of H_2S being estimated while the mixture of Ca Cl_2 and liquor are standing before filtration.

With regard to ratio of CO_2 and H_2S per cent. by weight and volume, it may be stated that at 30 inches B, and 60° Fahr.—

1 per cent. H_2S = 1·11 cubic feet per gallon
1 per cent. CO_2 = 0·8526 " " "

By multiplying these factors by the weight percentages, the corresponding volumes in cubic feet per gallon may be obtained.

TECHNICAL RECORD.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Annual Meeting in Berlin.

[Writing from Berlin last Tuesday, a correspondent sends us the following notes of the above meeting.—Ed. J.G.L.]

The Thirty-sixth Annual Meeting of the above-named Association commenced to-day. To-morrow is to be devoted to questions of water supply; and Thursday is to be occupied with further discussions on gas lighting. Friday, the last day of the conference, is assigned to visits to the gas and water works and electrical stations of the city. Last evening there was a reception and concert; and the Committee availed themselves of this opportunity to formally welcome the visitors to the meeting. There were present representatives of the gas industry from England, Switzerland, Austria, Sweden, and Russia; also MM. Duchène and Becker, Engineers of the Paris Gas Company; and M. Bouvier, a delegate from the Société Technique du Gaz en France. The President for the year is Herr W. von Oechelhaeuser, of Dessau.

Before proceeding to the business of the first day, it may be desirable to recall the circumstances of the present meeting. The city of Berlin organized a local industrial exhibition, which has been opened on the banks of the Spree. The Association of German Gas-Fitters have an exhibit there, and distribute their publications to visitors. It shows a remarkable collection of lamps in ancient Roman pottery, as well as a set of antique lighting appliances leading up progressively from the primitive pine-torch to the oil-lamp. This series provides the material for a historical review of means of illumination, such as Paris afforded in 1889. Further, this exhibit contains scientific apparatus for the analysis of gas, coke, and tar, and the estimation of sulphur, ammonia, &c. Besides these, there are shown by manufacturers of gas apparatus at Berlin, such as the firms of Pintsch, Elster, F. Siemens, &c., all kinds of appliances, including wet and dry meters, governors, cooking-stoves, and geysers. Incandescent lighting has an important position not only in the saloon devoted to gas exhibits, but also in the general lighting of the Exhibition. The Auer Company exhibit their numerous patterns of burners for both public and private lighting; and the firm of Schülke and Brandholt show suitable lanterns. Especially noteworthy are the lamps supplied with gas at high pressure, by compressing it, by means of a Roots

blower, to a pressure of 40 inches of water. The ordinary Welsbach burners fed with gas at this pressure consume 7 cubic feet per hour instead of half this quantity; but the light is equal to 200 Hefner units (175 English candles), in place of 50 units (44 candles). Actually, 35 candles per cubic foot of gas is the duty obtained, and 3·53 cubic feet furnish as much light as one ampère of electricity in an arc lamp.

The Inaugural Address of the President commenced with a review of the progress of the gas industry since the date of the last meeting in Berlin twelve years ago. In this period, the consumption of 68 important German gas companies has increased by more than 2000 million cubic feet, or by 63 per cent., against 49 per cent. in the preceding twelve years. At the same time, the public have achieved great economy in gas consumption, since the Welsbach burner, according to the figures quoted above, has an efficiency ten times that of the old fishtail burner. Gas-cookers and gas-engines have spread to a remarkable extent; and whereas the largest single-cylinder engine in 1869 developed 30-horse power, to-day 200-horse power is obtained, and even 500 is contemplated, per cylinder. The use of gas-engines solely for driving dynamos for electric lighting is greatly spreading; and at Rheims, Bochum, Belfast, Ostend, and, under the control of the President himself, at Dessau, they have worked satisfactorily for nearly ten years. In the meantime, the gas locomotive has proved itself a competitor of the electric locomotive. In conclusion, the President said that the gas industry had developed in a most remarkable manner, and had from both scientific and commercial standpoints, a fine future before it.

On Thursday, the statistical paper by Dr. E. Schilling, on the development of gas-works in the past decade, should lead to similar interesting conclusions; and the description of the new gas-works at Cassel, by Herr E. Merz, will likewise point to the rapid progress of the industry. Scientific theory has been dealt with by Professor Wedding in his comparison of the consumption of energy in various sources of light. Herr Söhren, of Bonn, has given a historical sketch of the Welsbach burner; and Herr Körting has described the advantages which the gas-engine, supplied with either coal-gas or water-gas, possesses for electric lighting installations.

Considering the variety of the projected programme, it must be granted that the thirty-sixth conference of the Association will possess undeniable interest for the gas industry.

WESTERN (U.S.A.) GAS ASSOCIATION.

Annual Meeting at Chattanooga.

The Nineteenth Annual Meeting of this Association was opened on the 20th ult. by Mr. A. W. Littleton, of Quincy, the President. After some preliminary business had been transacted,

The President delivered an Inaugural Address, and referred at some length, in his opening remarks, to the present condition of the Association, and to his position, for some years, as Secretary thereof. One of the chief things it needed, was the publication of bound copies of the Proceedings at the annual meetings, for gratuitous distribution among the members. He preferred election by ballot to the present plan of nominating officers by a Committee. Although there were 422 gas undertakings in their district, only 105 were as yet represented on the Association books; and he ascribed such a position of affairs to the "dense conservation that still prevails in some circles of the gas industry." Referring to the rule that provided that every active member must be an officer or regular employee of a gas company, he urged it should be extended to include gas engineers. He spoke strongly in favour of the Massachusetts Gas Commission; and urged the establishment of similar Commissions in other States. They were especially necessary for the prevention of competition, and stopping the promotion of competing gas undertakings. While in favour of the formation of State or District Gas Associations, the President did not altogether favour the running of the same on the present lines. Unless thickly populated, and favoured with good railway connections, as was the case in Ohio, a State could not furnish a gathering large enough to discuss technical questions with advantage. His idea was that the State Associations should consist of gas companies banded together for mutual protection, principally against vicious legislation; and that the discussion of subjects having a bearing on the manufacture and distribution of gas might be left to the two large Gas Associations of the country. As showing the need for such combinations, he quoted several measures that were presented at the last session of the legislature of the State of Illinois. As to the question of municipal ownership, he thought it would remain a vexed one, so long as the public continued to elect dishonest and incompetent men to municipal office, but also that gas companies might do more in the way of popularizing themselves. Without pretending to be the personification of meekness and humility, it was possible for the gas manager to do a great deal towards securing the goodwill of the city officials, the press, and the public. He insisted on the importance of careful working in every department, so as to be in a position to sell gas at the lowest possible figure, as the day for high-priced gas had vanished, never to return. Attention was specially directed to the fact that the list of papers to be read was designedly shorter than usual, with the object of leaving ample opportunity for discussion. It had been suggested that papers should be taken as read at their meetings, in order to leave more time for discussion. When members forwarded the manuscript to the Secretary in time (which they never did), and when the members read the papers furnished in advance and brought their copies in their pockets (which they never would), it might be possible to carry out this excellent idea. In concluding, the President congratulated the members on the fact that, for the first time in their history, there was no loss by death to record during the year.

Mr. John Gimper, of Galveston (Texas), read a paper entitled "A Few Words on Naphthalene," in the course of which he pointed out that not only variations in temperature, but also the presence of moisture, was concerned in this matter. He claimed that depositions of naphthalene were always preceded and induced by depositions of water. If it were possible to take all the water out of the gas, and leave all the naphthalene in it, there would be no more subsequent trouble than if both were removed. Low heats were a successful cure for naphthalene; but in these days of sharp competition, this remedy was out of the question. He had, however, found a plan suggested by Mr. E. C. Jones last year to be a complete remedy. This consisted of admitting gasoline at the outlet of the holder. The reading of the paper was followed by a discussion, in which no fresh light was thrown on the subject.

Mr. A. C. Humphreys read a paper on "Self-Education in Gas Engineering," addressing himself particularly to those who, while earning their living, are also trying, or should be trying, to fit themselves for taking positions of greater responsibility and trust. He wished to help those who had the desire to improve themselves, but did not know how to go to work; and he also desired to inspire others to make this extra effort, who, so far, had been satisfied to plod along, doing no more than fulfilling their daily tasks. He considered at length the relations between theory and practice; quoting from a paper read by him on the subject before the American Gaslight Association in 1892. The first thing was to get a good general education; it was no use to start without that. Then the student might proceed to acquire a sound knowledge of arithmetic, algebra, plane and solid geometry, and trigonometry; remembering that it was necessary, not merely to undertand, but also to acquire some facility in the working out and solution of problems. In connection with these, mechanical drawing and surveying should be followed up. Some tried to bye-pass these studies; but it was almost impossible to master the problems of gas engineering without this sound elementary foundation. Then should come the study of physics and mechanics, carrying out the experiments relating to the same as far as possible; and next the elements of chemistry, with laboratory practice. A knowledge of applied mechanics, resistance of materials, and thermodynamics was also necessary. The student should avail himself, as far as possible, of guidance and supervision in these studies, as afforded by local technical colleges or classes. An allusion was here made to the work about to be undertaken by the American Gaslight Association in this connection. Attention was then directed to the practice in England; the opportunities afforded by the City and Guilds of London Institute being described at length. A series of simple test questions, whereby any young man might get some idea as to his present educational status, was given. The author insisted on the importance of letting theory and practice go hand in hand, and of trying to apply what was learnt to daily operations at the works. He advised the student not to be satisfied with mere superficial knowledge, whether practical or theoretical, but to be consciencious and thorough in his studies and in his practice. A successful gas manager must go yet further. He must know the laws of trade, be capable of dealing with workmen, and have a knowledge of book-keeping by double entry. A long discussion followed the reading of the paper; and it mainly consisted of amplifications and enlargements of the various topics and points of the paper.

Mr. B. E. Chollar, of St. Louis (Mo.), read a paper on "The (Alleged) Law of Inverse Squares." He said that this law was generally taught in such a way as to convey the inference and impression that it was based upon, and was due to, some inherent property of light itself; whereas, as a matter of fact, light had nothing to do with the law, and the alleged rule was simply a geometrical axiom. Having demonstrated, by means of diagrams, that a pencil of rays diverging from, or converging to, a point, decreases or increases in intensity, as the case may be, in accordance with the rule of inverse squares, that a beam of parallel rays remains the same indefinitely, and that light originating from a point and radiating from a surface would increase or decrease in intensity according to the angle of divergence or convergence, he went on to say that in ordinary practical life there was no light having one of these characteristics only, but that they were mixed in all conceivable proportions. The commercial value of artificial lights depended largely on these properties. There was a great deal of confusion as to the meaning of the term "diffused" light. A sharp light, such as that from a point, consisted of diverging rays only, and cast a clear-cut, well-defined shadow. The best example of diffused light, however, was that from the clouds, which gave a more or less blurred and indistinct shadow, and was composed of converging, parallel, and diverging rays. It was a light that had no

definite wave front, could not be brought to a focus, and did not come under the law of inverse squares. The larger the area of the source, and the greater the proportion of converging and parallel rays, the greater the diffusibility. This was illustrated by the case of the earth and the sun. It was argued that, according to the law of inverse squares, every square foot of earth would receive the converging energy from 10,000 square feet of the sun's surface, and the light and heat of the sun would be far beyond the limits of human conception. Artificial lights were diffusive in proportion to their size; and the more the light diffused, the further it departed from the law of inverse squares. Since the photometer was based upon this law, it was unjust to gas; and the actual value of a gas-light as compared to other lights was greater than that shown by the photometer. As gas-lights were larger and more diffusive than any other artificial light, they were prejudiced to a greater extent by the photometer indications.

Discussion having been invited, Mr. Humphreys said it might seem to some that a paper of the kind just read did not call for a detailed reply; but coming from one so well known as a successful gas engineer, there was danger in leaving it unanswered, as some might be led to doubt a fundamental scientific truth, instead of ascribing the apparent want of agreement between illuminating power and illuminating effect to the proper causes. The student might be led to believe there was no fundamental principle that could be safely accepted; and the public might say that they had good authority for ascertaining that the photometer by which gas was valued was based on a false idea. He understood from the paper that Mr. Chollar accepted the truth of the law so far as the radiation of light from a point was concerned, but disputed its applicability to light radiating in parallel or convergent lines. There was a fallacy here; for light could not radiate in other than divergent rays. The word "radiate" meant to send out from a centre. The behaviour of diverted or reflected rays had nothing to do with the question of natural lines of radiation; but Mr. Chollar's argument was based on the assumption that light was radiated, not only in divergent, but in parallel and convergent rays. Taking the case of the sun's rays, it was easy to show that, if there was 'any convergence of them towards the earth, everybody would be made uncomfortably warm. Mr. Chollar seemed to think that light was radiated in lines; and here the fallacy came in. It was convenient to speak of a ray and to indicate it by a straight line; but this only showed the direction of the light, and they must come back to the wave theory of light propagation, if any question was to be discussed with precision. Light did not radiate from a point in diverging lines, but as a wave or a constantly expanding sphere. It was produced by rapid vibration of the ether; and this vibratory action was propagated as a constantly expanding sphere. Mr. Humphreys went on to show that light rays are propagated without interference from other and intersecting light waves; and therefore that, if the law held good for a point, it also applied to any number of points assembled together as a surface, or to a source of energy that had area or volume. With the aid of a diagram, he proved that this view was correct, and that light was always radiated according to the law of inverse squares, unless a lens, or other modifying device, was interposed. On comparing two sources of radiant energy, it was necessary to eliminate, as far as possible, all modifying or limiting conditions. This was the usual practice in all scientific investigations; and the photometer, with its accessories, had been devised to this end. There were several conditions that had their effect on the final illuminating effect as appreciated by the human eye; but they were all outside of the present discussion, and there was no inherent principle in the construction of the photometer that was prejudicial or unfair to the gas. He did not agree with the assertion that the law of inverse squares was taught as if it was an inherent property of light, or that there was no satisfactory definition of "diffused" light to be found. With regard to the latter, there was some confusion in the paper between the actual property and its effects. Mr. Miller also questioned the conclusion arrived at in the paper; and considered that the author had demonstrated the truth of the law of inverse squares. Radiation was confused with reflected or controlled light, and a reflecting surface with a source of light. He supported the views respecting diffused light and the photometer as expressed by the previous speaker.

(To be continued.)

Proposed Water Commission for Cincinnati.—A Bill has passed the Ohio Legislature authorizing the Governor of Ohio, on petition of the Board of Administration of Cincinnati, to appoint a Commission to take charge of the improvement of the water supply of the city. A proposition to submit the question of improving the supply to a popular vote was defeated. The Commission is armed with great power. It may adopt plans already reported upon or have new ones made, and may have the present system improved upon the basis of municipal ownership or by a private corporation. In the latter case, the city is to operate the works and to have the right of purchase at ten-year intervals. There are to be five Commissioners, with yearly salaries of $4000 each, with the exception of one member, who is to be also a member of the Board of Administration, and to receive $2000 in addition to his present salary.

REGISTER OF PATENTS.

Water-Meter.—Vandeesteen, B., of Brussels. No. 8216; April 25, 1895.

This invention relates to water-meters of the piston class. It consists of a suitable casing, with a moveable cylinder therein, adapted to move backwards and forwards on two pistons fixed to the casing. The water to be measured enters a distributing-box, in which is arranged a slide-valve, which, by its to-and-fro movement, opens and shuts suitable ports for the entry of the water into the meter. This rocking movement effects communication between the ports and a suitable discharge outlet. The two pistons being fixed, the hollow cylinder moves alternately to and fro under the pressure of the entering water; and it serves as a means for operating the slide-valve through the medium of a rod, carrying on its free end (at right angles thereto) a rod, provided with suitable spring cushioning devices—the rod, and therefore the slide-valve, receiving a to-and-fro motion by means of stops on the cylinder. The cylinder is formed with two compartments, separated by a partition; the compartments being gauged serve as measures. When the cylinder has completed its forward or its backward stroke, it has become full on one side and empty on the other side, through the piston-rods being hollow and communicating with the distributing-box by means of the slide-valve. The spring cushioning device is intended to cause the slide-valve, when the cylinder is at the end of its stroke, to move a suitable distance, so as to open the inlet-port on one side, and to close the inlet-port on the other side, and at the same time to make communication between one inlet-port and the outlet-port, in order that the water may flow away through the discharge pipe or outlet. One of the springs being compressed, a suitable stop acts by rising; and the slide-valve slides under it by the action of the spring up to the end of its stroke. The slide-valve has fixed to one of its vertical sides a pivot pin, which, by means of a lever, transmits motion to a shaft passing through the wall of the distributing-box by means of a stuffing-box, and imparts its rotary motion to an index working over dials placed in the box.

Incandescent Gas-Burners.—Stringfellow, J. H. W., of Hackney. No. 10,743; May 30, 1895.

The object of the present invention is (in the words of the patentee) "to produce a body capable of giving out incandescent light, after the manner of the well-known lime-ball—that is to say, giving light from the surface of a more or less solid form of incandescent body, as distinguished from the mantle series, such as the Sellon-Lewis, the Clamond, or Welsbach inventions, or the more recent De Mare invention."

As the result of his investigations, with the view to produce a small or large power incandescent light, by means of a solid body, the patentee now proposes to make an incandescent body, the foundation part of which is composed of substances having the nature and properties of meerschaum—*i.e.*, materials possessing a combination of lightness, coherence, and slow conduction. This foundation part he coats or covers with materials capable of becoming readily incandescent, such as certain of the metallic or natural oxides, asbestos filament or dust, and other suitable materials; these materials being used sometimes alone, and at other times two or more in combination, also with and without the aid of suitable cementing matter for attaching the incandescing material to the foundation. When the gas-flame is caused to impinge upon, or to travel over, the surface of such an incandescent body, the non-conductivity of the interior part is said to allow the exterior incandescing material to absorb and economically utilize the energy of combustion for production of luminosity.

One mode of carrying out the invention is as follows: The patentee takes a piece of meerschaum, and turns it to the cylindrical or other desired shape, say, about 3 inches long by $\frac{5}{8}$ inch diameter at its larger part. Then, for the sake of convenience in fixing it on a gas-burner, and to aid in non-conduction, he drills a hole through the central length of it. Then he takes a piece of thick cloth, preferably of cotton, uncoloured; and after making it jagged on one face of it (if it is not so originally), he immerses it in a solution of oxides capable of producing suitable incandescence. This cloth he then dries, cuts to shape, and attaches to the meerschaum body at certain points by any suitable refractory cement—say, silicate of allumina—taking care to make allowance for subsequent shrinkage of the cloth. Then he again dries it, and afterwards subjects it to a destructive non-carbonaceous heat, to dispose of organic and volatile matter. When this has proceeded far enough, the incandescent body will be ready for use by being affixed to a suitable bunsen burner, or to a luminous flame burner; provided, in the latter case, that the incandescent body and the flame are so adjusted, that only the zone of complete combustion of the flame passes over or in contact with the incandescing material. The effect required is merely to utilize the inner non-luminous face of a luminous flame, such as an argand flame, in order to increase its power and luminosity.

As an alternative, the patentee takes silicic acid and carbonate of magnesia in the proportions by weight of four of the former to one of the latter; bringing them to a plastic state by a suitable quantity of water. He then takes silicate of alumina, and brings it to a plastic state by means of water. Next, he takes equal proportions by volume and approximate weight of the two compounds, and mixes them together. He then moulds some of this compounded plastic material into such a form as may be desired, which can then be stoved and dried ready for use. Or he moulds a rough shape, larger than the body required, which he stoves, dries, and then turns to the required shape by the lathe, and drills the hole through it. Then he affixes the incandescing material upon it, as described for the meerschaum body. Or he takes strips of cotton, rendered durable and incandescible as before described, which he affixes in the form of vertical wings or leaves from bottom to top of the solid body, and preferably extending about $\frac{3}{8}$ inch from the face of it, so that they are in "the suitable flame zone for producing incandescence."

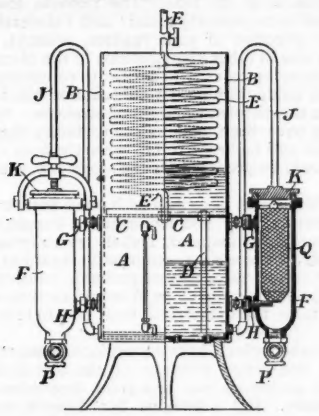
Mechanism for Automatically Cutting-Off Gas.—Phipps, T. J., of Watford. No. 12,035; June 20, 1895.

In this arrangement, the patentee proposes to employ an ordinary

clock having an ordinary train of alarum wheels. Upon the arbor of the great wheel of the train of wheels is affixed a wheel or barrel, around which a cord can be wound. Another arbor of the train driven by the great wheel is, as usual, impeded from turning by an arm (or preferably one or other of two opposite arms upon it) coming against a pin-stop except at the time at which the pin is moved out of the way by the going of the clock. When the stop-pin is in position to prevent the turning of the wheels, and the cord is pulled on the spring which is to revolve, the main wheel is wound up as the cord is drawn off from the barrel or pawl and ratchet-wheel; an arrangement being provided to allow the barrel and its spindle to turn in the direction without the great wheel turning with it. When the stop-pin is withdrawn, the train of wheels is revolved by the spring; and the cord is again wound up on to the barrel, and is made either to turn a gas-tap to shut off gas from a burner, or to shift the moveable part of an electric switch to cut off electric current. The alarum movement—preferred for use is one in which—as in some alarum movements heretofore made—the wheel which serves to hold the pin-stop in acting position, and which is driven from, and at the same speed as, the hour-hand spindle, is outside the frame which carries the train of clockwork wheels.

Generating Acetylene Gas.—Exley, J. H., of Huddersfield. No. 12,344; June 26, 1895.

This invention relates to the combination with a receiver having a water cistern immediately above and connected to it by a pipe extending below the minimum working level of the water in the receiver, of an external acetylene gas generator connected to the receiver by both a gas-passage and a water-passage.



The receiver or holder A has a water-cistern B of fully the same capacity mounted above, but separated from it by the diaphragm or horizontal partition C. A pipe D connecting the receiver with the cistern is fixed in this diaphragm, and extends almost to the bottom of the receiver; and a delivery-pipe E from the receiver is also fixed in the diaphragm, and carried out at the top of the cistern and connected to the service-pipe. The pipe E is preferably formed into a coil in the cistern for the purpose of cooling the gas passing through it. Two vertical generators F are fixed to the side of the receiver, and are each connected to it by a gas-pipe G and a bottom water-pipe H. A lid K is fitted to the top of each generator, which may be held tightly down against it by a screw in the bridge-piece extending diametrically across the top of the generator, and pivoted on studs fixed in the rim of the generators. A discharge-tap P is fitted in the bottom of each generator, to enable the water and residual matter to be drawn off when required. A wire or perforated cage Q, filled with carbide of calcium, is placed in each generator.

To put the apparatus into operation, the cocks between A and F and A and G are closed; and the receiver is filled with water, as well as a few inches up the cistern to form a reserve. Then the lids of the generators are removed; and the cages filled with calcic carbide are placed in position in the generators, and the lids again secured. Assuming that the generator F is first used, the taps in the gas and water passages G and H are each opened; and the water from the receiver is admitted to the generator. The generation of gas at once commences; and it passes into the receiver, displacing the water therein, and forces it up through the pipe D into the cistern B, until the water in the receiver falls below the level of the calcic carbide in the cage Q. The generation of gas then ceases, and is only resumed when the consumption of gas allows the water to again rise in the receiver and generator, and again combine with the calcic carbide.

A pipe J is preferably fitted in the top of each generator, and is carried up more or less to the top of the water-cistern, and then down again; and it is connected to the holder. This pipe forms a safety-pipe, and renders it impossible to create excessive pressure in the generator.

Gas-Motors.—Compagnon, A. le, and Guibert, J., of Paris. No. 13,047; July 5, 1895.

This invention—relating to motors operated by the explosion of a combustible vapour or gas which requires compression before ignition—consists in its essential characteristics in the employment of two cylinders, superposed one above the other, in each of which work two pistons, having piston-rods and connections arranged outside at either end of the open cylinders, so as "to suppress the vibrations in the motors, and thus to avoid heavy masonry and foundations." In each of the cylinders there are two trunk pistons, separating from, and approaching to, one another in the axes of the motor. The cylinders are furnished with the valve-boxes, in which are the usual ports of admission and exhaust for the gas, with corresponding valves therein. The connecting-rods of the pistons are pivotably connected to balance-levers, which oscillate round the pivots, and to which are attached pins carrying the usual brass bearings of return connecting-rods, which operate at their other ends the crank of the shaft carrying a fly-wheel. A pinion is keyed on the shaft, and engages with a cog-wheel upon a countershaft, which operates, by cams, the valves of the exhaust, by suitable rocking-levers controlled by a governor.

The motor is of such type that, at every reciprocation of each piston, a cycle is produced in four steps—viz., (1) suction; (2) compression; (3) explosion; (4) exhaust. But the cycles in the two cylinders are successive in order respectively, so that in the second cylinder the steps in the same time as the above cycle are: (1) Exhaust; (2) suction; (3) compression; (4) explosion. In known gas motors with this cycle, there is only one explosion stroke in two revolutions of the main crank; but in the present motor, there is an explosion stroke at each revolution of the crank-shaft.

Preventing Bunsen Gas-Stove Burners Lighting-Back.—Cannon Hollow-Ware Company, Limited, and Ward T., of Deepfields, Staffs. No. 13,236; July 9, 1895.

The object aimed at in this invention is accomplished by forming the conduit or tube of the burners with two or more quick or short bends, from which the mixed gas and air flow in a direction opposite to, or considerably backward from, that in which they approach such bends, respectively; so that any back-flow along the conduit or tube is checked sufficiently to prevent the flame travelling back through its length. The tube is, in practice, preferably formed of a syphon-shape, by making it of three lengths, of which one is joined at its opposite ends, respectively, into each of the others by means of a quick bend. One of the ends of the tube which is formed with quick bends, receives the gas and air; and the mixed gas and air are burnt at the other end of the tube, or at openings with which the tube communicates, and which are situated beyond the quick bends.

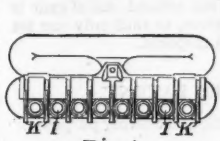


Fig. 1.

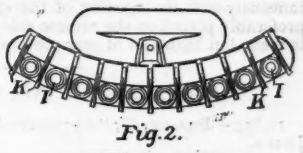


Fig. 2.

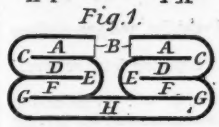


Fig. 1 is a plan and section of a gas-burning appliance of the bunsen type, for use with a straight-bar open or domestic fire-grate, for the purpose of rendering incandescent a supply of asbestos placed loosely in the grate.

The tubes along which the mixed air and gas pass on their way to the nozzles are formed with straight portions A, having open ends B, which receive the air and gas in the usual manner. The portions A are joined at their outer ends by quick bends C, with straight portions D, which run parallel with the portions A. The portions D are joined at their inner ends by quick bends E, with portions F, which run parallel with the portions A and D; and the portions F are joined at their outer ends by quick bends G with the straight tube H, with which the nozzles I directly communicate. K are the ordinary guards to keep the asbestos clear of the mouths of the nozzles. The quick bends which join together the straight lengths of tube through which the mixed gas and air pass on their way to the nozzles, securely prevent the flame from running back and burning at the inlets B. In reality, there is only one tube to the appliance, as the portion H is formed with a clear passsge-way throughout. But, in effect, there are two tubes, one of which supplies mixed gas and air to one-half of the nozzles, and the other to the other half; and the middle of the portion H might be closed across with a diaphragm. Each passage-way from an inlet B to a half set of nozzles is therefore regarded as a single passage-way or tube. The upper sides of the portions A of the tubes are made continuous with one another, as shown, and, as is usual, to keep down any gas which rises before entering the tube.

Fig. 2 shows a similar arrangement of burner for a curved-bar grate.

Controlling the Steam Supply to Water-Gas Generators.—Cutler, S., of Millwall. No. 13,446; July 12, 1895.

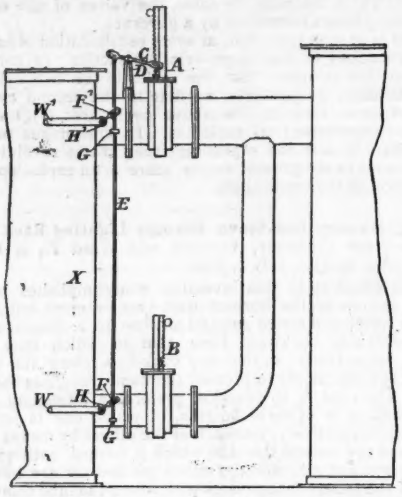
This invention for controlling the steam supply to water-gas generators consists in a method of actuating the steam-admission cocks simultaneously with the gas-outlet valves in such a manner that steam cannot be admitted to the generator if the corresponding gas-outlet valve is closed. The invention is particularly applicable for generators which have two steam-admissions and two gas-outlets; but it is equally applicable where the gas-valves are worked singly, or where they are coupled together. In the former case the invention also prevents steam being admitted to the generator if by any error the gas-valves are either open or shut.

In carrying out the invention, the patentee proposes to connect some moving part of the gas-outlet valves by means of suitable gearing to a number of single-way steam-cocks, and thus actuate them simultaneously with the gas-valve. Where the generator has its two outlet-valves worked singly, he actuates two single-way steam-cocks from each valve; and where the gas-outlet valves are coupled, he actuates one single-way steam-cock from each valve or (alternatively) two cocks from either valve.

The illustration (p. 1398) shows in elevation one method of applying the invention.

A water-gas generator X has two gas-outlets controlled by valves A B, and two steam-admissions W W^1 controlled by steam-cocks H H^1. The valves are worked singly, by suitable gearing, and are of the "outside rack-and-pinion" type. To the rack of each valve is connected a lever C, pivoted on a fulcrum D, and connected to a rod E, free to rise and fall in guides G. Upon this rod pivots are provided for slotted levers F, F^1 attached to the steam-admission cocks H H^1. The

levers F F^1 are set in such a manner that, when the upper gas-valve A is opened, the upper steam-cock H^1 is closed and the lower one H is opened. By a corresponding set of gear connected to the valve B, a



lower steam-cock is closed and an upper steam-cock is opened simultaneously with the opening of the valve. This second set of gear is preferably placed on the reverse side of the valves, so that only one set is seen; but both sets of gear are similar in all respects.

APPLICATIONS FOR LETTERS PATENT.

11,855.—Fraser, P., "Apparatus for lighting and heating purposes." June 1.

11,863.—Wood, C. F., "Self-propelling road vehicles, and gas-engines therefor." June 1.

11,873.—Andrews, D. F., "Disinfecting gas escaping from sewers." June 1.

11,938.—Hawkins, T., Welby, A., and Carr, J. W., "Production of gases to be used for fuel heating and steam-engines and for driving gas-engines." June 2.

11,951.—Meikle, J., "Treating peat, coal, and other carbonaceous substances for obtainment of illuminating gas." June 2.

11,955.—Young, W., and Hislop, G. R., "Production of illuminating gas from liquid hydrocarbons." June 2.

11,972.—Wolstenholme, J., and Bennett, J. F., "Gas-engines." June 2.

11,974.—Davis, C. W., and Turner, H. C., "Gas-burners adapted to heating, cooking, and boiling stoves." June 2.

12,046-7.—Fourchotte, M. C. A., "Generating acetylene gas." June 2.

12,055.—Kern, G., "Producing acetylene." June 2.

12,068.—Birch, W., "Ventilating and heating by means of gas or oil, or by coal or coke fire." June 3.

12,109.—Hereng, P., "Carburetting apparatus." June 3.

12,112.—Roach, G., "Gas lighter and bye-pass regulator." June 3.

12,123.—Parsons, E. J., "Simultaneously raising and lowering the lights of a series of gas-lamps, such as railway carriage gas-lamps." June 3.

12,319.—Richards, C., "Overhead lamps." June 5.

12,351.—Baggally, W. W., "Incandescent gas lighting." June 5.

12,358.—Clark, F., and the Southend Gaslight and Coke Company, "Lamps." June 5.

12,430.—Arter, A., "Treatment of gas for illuminating and other purposes." June 6.

12,455.—Lamplough, F., "Induction gas-burners for laboratory, mechanical, and general work." June 6.

12,481.—Eaton, S. T., and S., jun., "Bracket and chandelier arms for gas, oil, or electric light." June 8.

12,515.—Golby, F. W., "Gas and vapour burners." A communication from O. Lindner. June 8.

12,527.—Hancock, D., Craig, J. B., and Hancock, A. H., "Treatment of carburetted air or gas for heating purposes." June 8.

12,535.—Imray, O., "Horizontal coke-ovens." A communication from F. Brunck. June 8.

12,542.—Thompson, W. P., "Burners for gas and gaseous combustibles." A communication from the Gesellschaft für Stossfeste Glühlicht Brenner. June 8.

12,610.—Schuch, J., and Kneidel, H., "Gas-burners." June 9.

12,612.—Lea, J. W., and Perrins, J. H., "Incandescent mantle protectors." June 9.

12,632.—Spiel, J., "Gas incandescence lamps for heavy liquid hydrocarbons." June 9.

12,633.—Drake, J. A., "Oil or gas engines." June 9.

12,662.—Tobler, A., "Automatic generation and distribution of acetylene gas." June 9.

12,683.—Deroy, H. A., "Manufacture or production of acetylene gas." June 9.

12,725.—Smith, F. S., and J. H., "Turning gas or other taps by clockwork." June 10.

12,758.—Crouan, H. M. L., "Motive-power engines driven by gas or inflammable vapour." June 10.

12,771.—Whitfield, C., "Manufacturing producer and water gas." June 10.

12,788.—Gibbs, R. R., "Generation and storage of acetylene." June 10.

12,814.—Wilson, J., "Improved burner for incandescent gas lighting." June 11.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Columnless Gasholders.

Sir,—In consequence of not knowing the order in which the papers would be read at the recent meetings of The Gas Institute, I was unfortunately too late to be present at the discussion on columnless gasholders. As the first inventor of such, I may perhaps, however, trespass upon your indulgence for a few remarks, which may be acceptable to gas engineers in general.

It is said that new converts are sometimes more zealous for a cause than old believers; and there would appear to be, in this case, almost a danger—arising from an excess of new convictions—of encouraging unsafe extremes of construction. I, therefore, cannot too strongly emphasize the reminder, suggested by Mr. Pease in his reply, that no gasholder, or lift thereof, can keep its horizontality, *whilst it is in the act of being raised or lowered*, unless it is securely guided or held in position. When a lift is completely cupped, it is then in a different condition of stability, and is quite safe to go free—always provided the next lift below is sufficiently secured to hold it. In like manner, the cupping of any number of lifts may permit of their subsequent free ascent, until eventually they all depend for their entire support upon the base line of the structure. This is really the theory of columnless holders of whichever type. But full provision, in a properly constructed one, must be made for securing the holder in position during the operations of rising and falling and for power of final resistance at the base. The remarks made by Mr. Isaac Carr on this head were perfectly sound; and I sincerely commend them to the careful attention of your readers, without, of course, detracting from the value of other contributions to the discussion.

So long as any engineer remains who desires to construct his holder with columns or other guide-framing, I would caution him to be careful to see that these have the requisite margin of strength. Some recent proposals for framing have been made of such a flimsy character that, I fear, if adopted, they will be found to fail when the hour of their trial comes. A holder should be prepared for the *exceptional* wind pressures Mr. Carr alluded to.

The experiments Mr. Pease described as having been made respectively by Messrs. Terrace, Tully, and Irminger are interesting; and, as soon as I have the time at my disposal, I shall try to investigate both problems. I think Mr. Terrace's suggestion, with regard to the varying pressures under wind strain, offers a more probable solution of the one than distortion of the holder shell; as it would require a very considerable deflection from the cylindrical form to produce so great a discrepancy.

With regard to the other point, I have never placed great reliance upon the accuracy of the conflicting formulæ of the text-books thereon. Nevertheless I do not anticipate that any great theoretical correction will be found necessary. But I imagine Mr. Pease's suggestion of air swirl, or perhaps elastic reaction, behind the holder, may be found to have an appreciable, and possibly a very important, effect in accounting for the apparent low effective resultant vertical strain—always assuming there was no vitiating error in the experiments.

It is no part of my object, neither is this the place, to discuss the relative merits of the different types of columnless holders now become so familiar. But I may perhaps be permitted to express the opinion that the time is not far distant when the least excellent of these will be accepted in preference to the most elaborate system of columns which may be designed.

W. Gadd, C.E., F.R.M.S., &c.

Manchester, June 19, 1896.

Crossley Gas-Engines—An Explanation.

Sir,—In your issue of the 16th inst., we notice one or two extraordinary inaccuracies about gas-engines which we beg you to correct in your next issue.

On p. 1329, in an article on "Gas Engines as Economical Motors," by Mr. J. Holliday, of Scarborough, you mention that the River Wear Commissioners, at Sunderland, last year introduced several Tangye gas-engines of 120 maximum indicated horse power, coupled direct to centrifugal pumps, for emptying the Graving Dock. The true facts of the case are these: Two Tangye gas-engines were put down by Mr. Wake, the Engineer of the River Wear Commissioners, for emptying the No. 1 Graving Dock; while three of our engines, each of 120 brake (not indicated) horse power, were put down for emptying the No. 2, and larger, Graving Dock, each one attached direct to a 22-inch Gwynne and Co.'s centrifugal pump, and each capable of lifting 2380 tons of water an hour 24 feet high.

Then on p. 1338, in commenting upon Mr. Lineham's lecture on "The Development of the Gas-Engine," it is mentioned that, although we had made double-cylinder engines of 600 and 700 brake horse power, since the makers of the "Simplex" made one of 350 brake horse power, the credit of introducing engines of this power belongs to the makers of the "Simplex" engine. In reply, we can only say that we have never made engines anything like approaching this power, nor have we manifested any intention of wresting from this firm the laurels which your correspondent considers are so properly their due.

D. H. Irwin, Director,
Crossley Bros., Limited.

Manchester, June 19, 1896.

[It should be pointed out that we are not responsible for the statements contained in Mr. Holliday's paper—not "article," as our correspondent calls it; and with regard to Mr. Lineham's lecture, what we gave was merely an abstract report of his remarks, and not an editorial comment upon them.—Ed. J.G.L.]

Professor Lewes on the Value of the Sunlight Mantle.

Sir,—Referring to the letter you have received from Mr. Moeller, of the Incandescent Gas Company, I beg to point out shortly the very great errors into which Mr. Moeller has fallen.

Firstly, Professor Vivian Lewes was not one of the expert witnesses

for the Sunlight Company in the recent trial; and except as to a test made by him of mantles sent by the Sunlight Company, in the end of April, to the City Gas-Testing Laboratory, he had absolutely nothing to do with our Company prior to the lecture quoted by Mr. Moeller. It was no doubt, however, the extraordinary results of his tests of our new mantle which led to these remarks; and we understand Mr. Moeller's annoyance in this connection.

In the second place, I beg to point out that, although Professor Lewes had not a sufficiently long knowledge of our mantles to speak of their life, Mr. Otto Hehner, who was one of the Sunlight Company's expert witnesses, did speak in the discussion which followed Professor Lewes's paper, of the life of an alumina and chrome mantle in the most emphatic terms. But upon this question of the durability of our mantles, both in light and structure, we are about to make an offer to the public which will more than answer the interested comments of our opponents.

Lastly, I beg to point out that, knowing as we do the very faulty arrangements for manufacture to which the Sunlight Company have hitherto been forced to submit, we have taken great pains to prevent the delivery of any of our new mantles, and will not commence the delivery of them to anyone until our new factory is in complete order for meeting the demand which we have every reason to know will be very great.

I would take this opportunity of saying that we are more than astonished at the audacity with which the Incandescent Gas Company continue to talk of 1000 hours as the life of their mantles, when it is notorious in the trade that, in practice, the real life is exceedingly short.

G. Oppenheimer, General Manager,
New Incandescent (Sunlight Patent) Gas Lighting Co., Limited.

40, *Coleman Street, E.C., June* 22, 1896.

Preventing Freezing in Gasholder Cups.

Sir,—May we remind your readers that almost all gasholder makers have some very excellent apparatus for this purpose, and that the firm who wrote you last week are by no means the only makers?

June 20, 1896. One of the Other Makers.

Leeds Gas Workers and Pipe-Laying Contracts.—The Leeds gas workers are greatly concerned just now over a proposal of the Gas Committee of the Corporation to have the pipe-laying work done by contract; and "mass" meetings have been held, under the auspices of the local branch of the Gas Workers' Union, to protest against the change. It is feared by the gas workers that, if the work is let to contractors, it will be scamped; and public life, health, and prosperity will be seriously endangered. Resolutions to this effect were passed at the meetings referred to.

The Farnborough Gas Company and the Aldershot Gas and Water Bill.—At an adjourned meeting of the Farnborough Gas Company, held on the 10th inst., the following resolution was carried unanimously: "That the Bill of the Aldershot Gas and Water Company as passed by the House of Lords, and as proposed to be introduced in the House of Commons, is, so far as it affects the Company, hereby approved; and that the agreement now submitted between the Company and the Aldershot Gas and Water Company is hereby approved; and that the seal of the Company be affixed thereto."

Exeter Corporation Water Finances.—The accounts of the Water Committee of the Exeter City Council for the year ending March 25 last shows a gross surplus of £1173; but the following sums have been deducted in respect of the several suspense accounts: Filter-beds, £63; turbines, £197; new engines, £258; and retained for depreciation, £100—total, £618. It is proposed to carry the balance to the credit of the district fund account. The sums mentioned will extinguish all suspense accounts; the filter-beds, turbines, and new engines being now paid for. At Danes' Castle, the pumping power has been increased by 200,000 gallons a day, without any additional expenditure for coal.

Mossley Corporation Gas Accounts.—The annual report of the Auditors upon the Mossley Corporation gas-works accounts for the past financial year is as follows: The net loss for the year is £223 4s., as against a net profit of £1155 8s. 10d. for the year ended March 25, 1895. This difference in the result is chiefly owing to the heavy increase in the charge against the revenue account for the repairs and maintenance of works and plant; the amount being this year £1946 18s. 11d., as against £814 5s. 8d. for the previous year. The former of the two amounts may be liable to modification by an allocation as between capital and revenue of a portion of the cost of certain improvements, which will be completed during the current year. The percentage of gas unaccounted for, according to the summary of make and sales, is again very heavy; being 15·67 per cent. on the quantity sent out. Provision as required has been made for the sinking fund amounting to (including interest) £615 5s.; and the insurance fund has been increased by the interest, amounting to £73 2s. 9d.

Ashton and District Joint Water-Works Committee.—The balance-sheet of this Committee for the year ending March 25 last has been issued. There are separate accounts for the Ashton and Hurst, the Stalybridge, the Dukinfield, the Mossley, and the Swineshaw Sub-Committees. The receipts on revenue account for the year from the first of these Sub-Committees amounted to £14,647; from the second, to £5323; from the third, to £3288; and from the fourth, to £3080. The Committee have paid in management expenses out of cash received from supply districts, £2193; to Swineshaw Sub-Committee, £821; to Ashton Corporation, £9203; Stalybridge Corporation, £6573; Dukinfield Council, £3944; Mossley Corporation, £2665; Hurst Council, £1599; and there is a balance left in bank of £426. The capital and liabilities of the Joint Committee are stated at £706,063. The property and assets are grouped under the following heads: Greenfield works, £299,018; cost of arbitration and award (*re* value of existing undertakings transferred to the Joint Committee), £22,397; existing undertakings transferred July 1, 1878, £338,117; extensions and improvements, £28,611; district Sub-Committees' balance of current accounts, £17,920.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Edinburgh Extension Bill, Water Provisional Orders Bill.

Bills read a second time and committed: Bexhill Water and Gas Bill, Chelsea Water Bill, Eastbourne Water Bill, Lambeth Water Bill, London Sea Water Supply Bill.

Bills referred to a Select Committee consisting of Earl Belmore (Chairman), the Marquis of Hertford, Lord Rodney, Lord Aberdare, and Lord Pirbright: Brighton Corporation Water Bill, Huddersfield Water Bill, Lanarkshire (Middle Ward District) Water Bill.

Bills reported, with amendments: Bexhill Water and Gas Bill, Dublin Corporation Bill, Lambeth Water Bill.

Bill read the third time and passed: Colwyn Bay and District Gas Bill.

Opposition withdrawn; Kirkcaldy and Dysart Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: Dalmeny and Kirkliston Water Provisional Order Bill, Kilmarnock Corporation Water Bill.

Bills reported: Burton-upon-Trent Corporation Bill, Drogheda Corporation Bill, Gas and Water Provisional Orders Bill [Matlock Bath Order not proceeded with], Kelty Water Provisional Order Bill, Malvern Link Bill, Manchester Corporation Bill, Water Provisional Orders Bill, Ystradyfodwg Urban District Council Gas and Water Bill.

Bills read the third time and passed: Barnsley Corporation (Water) Bill, Edinburgh Extension Bill, Padiham Urban District Council Water (Extension of Time) Bill, Yeovil Corporation (Water) Bill, Water Provisional Orders Bill.

A petition against the East Surrey Water Bill was presented from the Corporation of Reigate.

HOUSE OF LORDS COMMITTEE.

Wednesday, June 10.

(*Before Lord* Kensington, *Chairman; Lord* Saltoun, *Lord* Ashburton, *the Earl of* Ranfurly, *and the Earl of* Malmesbury.)

DUBLIN CORPORATION BILL.

To-day the gas clauses of the above-named Bill came under the consideration of the Committee, which had been re-constituted since the hearing of the water portion of the measure before the Whitsuntide holidays (see *ante*, p. 1272). The result, as stated in the Journal last week, was the rejection of the Corporation's proposals.

Mr. Pember, Q.C., Mr. Balfour Browne, Q.C., Mr. Macinerney, Q.C., Mr. G. Fitzgerald, and Mr. J. O'Connor appeared for the Corporation; Mr. Littler, Q.C., Mr. Pembroke Stephens, Q.C., Mr. J. D. Fitzgerald, Q.C., and Mr. Gordon represented the Alliance and Dublin Consumers' Gas Company.

Mr. Balfour Browne said he proposed to call Mr. T. J. Cotton, the Inspector of Public Lighting for the Corporation, and to examine him in the first instance as to three clauses of the Bill—13, 14, and 15—which dealt with the provision by the Corporation of testing-places for testing the illuminating power of the gas, and also with the matter of the apparatus to be employed for such testing.

Mr. *T. J. Cotton*, examined by Mr. Balfour Browne, said he was the Inspector of Public Lighting in Dublin for the Corporation and the Official Inspector of Meters under the Board of Trade. He had been connected with these offices for the past eight years. With regard to the clauses referred to, it was the view of the Corporation and the citizens of Dublin that the present arrangements for the testing of gas were inadequate; and they wanted to have them put on a proper footing. The gas-testing for the past few years they considered was not a reality at all. He thought only one of the numerous mains serving the city passed the present testing-place; and, of course, any gas supplied to the citizens of Dublin that did not pass the testing-place went to their burners without any check.

Mr. Balfour Browne: Is it possible, under the present arrangement, for a portion of the gas to be supplied to the consumers without there being any test at all?

Witness: The Corporation believe that there is no full and efficient test of the gas to the consumers. As I said, only one of the numerous mains passes the testing-place, and as long as this arrangement continues, it is possible for the Company to supply gas of various qualities.

And is it possible for certain gas, after it has passed the testing-place, to mix with other gas that has not been tested?—It is.

The Chairman: Do I understand from the witness that at this moment there is only one testing-place in the whole of Dublin?

Witness: Yes; that is so. It is situated at the corner of Townsend Street, crossing over to Butt Bridge.

In further examination, witness said there were two gas-works in Dublin. One of them had not been operating for some years; but it might—and he hoped it would—be doing so again soon. Witness went on to describe the working of the valves in the vicinity of the O'Connell Bridge, by which, if necessary, the gas could be sent from the south side to the north, or *vice versâ*. He also explained the position of the gas-mains; adding that the townships around Dublin had to be content with the present system of testing, as they obtained their gas from Dublin, and had no testing station of their own. He

went on to say that the Corporation in their Bill provided for four testing-stations; and the places were chosen with the object of testing the quality of every cubic foot of gas that went to the consumers. At present there were no efficient means of ascertaining it; and they had to take the word of the Company for it. The Corporation undertook to provide and maintain these testing-places at their own expense; and therefore he did not see how the Company could complain, unless they objected to having a stop put to the supply of gas that ought not to be supplied. Witness mentioned that in London there were 23 gas-testing stations, all of them under the control of the County Council or the Corporation; and what the Dublin Corporation wanted was that the Dublin consumer should have the same guarantee as to his gas that the London consumer had, and that the Corporation should have control of the matter. There had been a good deal of friction in Dublin in consequence of the gas-testing being under the control of the Company. The Corporation did not think they had proper facilities to see whether or not the gas was properly tested. Another matter they wanted to ascertain was the quality of the gas during the daytime. This power was in the hands of the Corporation for a number of years—from 1866 down to 1873. The same arrangement existed in London, where the gas might be tested at any hour of the day. There was a good deal of gas used during the day in Dublin for heating, cooking, gas-engines, and purposes of that sort. At present the gas could not be tested until after six o'clock from March to October; and long before six in April and September the consumers' shops were lighted up. No test could be taken in the winter months until after five o'clock, although the consumers used in some of these months a very large quantity of gas before five. Another matter was that the Company locked up their testing-station upon holidays and Sunday afternoons; and there were great complaints of the quality of gas supplied in Dublin during Sunday afternoons. The Corporation wished to have the gas tested every day of the year, and at any hour the Corporation might desire. The Bill provided for a fifth testing-station in the event of a new district being opened up. The Company were fully protected in the action the Corporation proposed taking, because the sanction of the Board of Trade had to be obtained for the testing-station, as well as for the apparatus, before either could be used.

Mr. BALFOUR BROWNE: Is there much truth in the old theory that gas, after it passes (say) 1000 yards from the main, loses a large portion of its quality?

Witness: That is an old theory; and I believe it to be entirely exploded. It is found that ordinary coal gas loses very little by passing away a long distance from the main. In London, the gas is tested seven and eight miles from the works; and the difference would be very small indeed.

Now, with regard to the apparatus used by which the testing is carried out, I understand it has been said that for the last few years the testing has been more or less of a sham. I do not use an offensive word, but I believe it has not been satisfactory?—It has not been a reality; and for this reason, that you have a public testing-station which the Corporation refuse to acknowledge, and you have the gas tested there by a gentleman whose appointment was ratified by the Board of Trade. That gentleman uses a class of photometer for testing which the Board of Trade will not sanction, but, on the contrary, which has been repudiated by the Board of Trade and the Corporation as well. I advised the Corporation upon this. But, independent of any advice, they examined the photometer themselves—I will not call it a photometer, for it is not one—and the instruction they issued afterwards was that this means of testing should not be recognized by me. The object of this was to force the Company to use a photometer that would give a proper test—a fair measurement of the gas—and one that will be duly stamped, and have the sanction of the Board of Trade.

When you want to carry out a test at present, do the Company allow you to have the testing-room to yourselves, or do they keep some of their officials in the room?—As a rule, they have two officials in the room. These gentlemen appear to regard the testing-room more as a private department than a public one, because they do not give the Corporation the facilities they ought to receive. The Directors were appealed to to put a stop to this state of things. They endeavoured to do so; but the interruptions to proper testing continued, and go on up to the present. The Corporation have power to have only one Gas Examiner. I have to do all the work; and, work as hard as I can, I find it impossible to test the gas every day.

In further examination, witness explained that if the Corporation obtained power to erect the suggested testing-stations, they proposed to use either a 60-inch open Letheby photometer, or an Evans closed and improved 100-inch photometer. The instrument at present in use was a mutilated one—a sort of specially constructed photometer. One of the objections to the existing test was that the candles burned in a vitiated atmosphere while the test was proceeding; there being no proper ventilation provided for in the chamber. Another was that the air which supplied the gas-flame with oxygen became very hot after a short time; and the result was that it gave the gas additional illuminating power not really due to the quality. No such fault could be found with the photometers which the Corporation wished to have used for testing purposes, and which he believed would give trustworthy results. In 1874, when the Company promoted a Bill to relieve them from supplying 20-candle gas, Dr. Tichborne was appointed Gas Inspector by the Board of Trade. His appointment was a novel one in this way: So far as the Corporation were aware, he was not responsible to the Board. He had no power whatever over the Company, nor had the Corporation any power over him. He was obliged to make one test of gas a week, and have it published in the newspapers. In London, the County Council or the City Corporation had absolute power over the gas-testing, and appointed examiners. He believed that alterations had been made in the present gas-testing instrument in Dublin; but he could not say that any officials of the Company made them. In consequence of the friction which existed, the Corporation came to the conclusion that it would be necessary to have recourse to arbitration; and, for this purpose, they in 1889 employed some experts in England as well as in Ireland. These experts were to examine the testing-station and the testing of the gas. They agreed with him, after examination, that the place was overheated. They tested the quality of the gas, and found it below the standard. They went before the Arbitrators; and it was decided that the testing-station should be connected with two large mains in the city, and that in future an Evans closed 100-inch photometer should be used. This part of the award was a little vague, as it did not indicate whether the photometer was to be of the old or the new pattern. The old pattern was a well-known photometer at the time of the award, and was in use in several places. It went without saying that it was absurd not to have a testing-place for all the gas that went to the consumers. The Corporation's provision for additional testing-stations outside those actually desired at present, was to meet the possible necessities of the future; but by clause 14 of the Bill, they left the decision in this matter to the Board of Trade.

Cross-examined by Mr. GORDON, witness said he had been in the service of the Corporation since May 10, 1888. He was the sole responsible officer of the Corporation with reference to gas, and was the only person connected with them having scientific skill in the matter. The Corporation were dependent upon him, with the exception that they employed experts from time to time to verify his tests. The gas clauses of the Bill were not his. He assisted in the framing of them—giving the practical information necessary; but they were drafted by the late Lord Mayor (Alderman Dillon), who was an experienced lawyer, and they were taken generally from Companies' Amendment Acts, and from the Acts of The Gaslight and Coke Company, the South Metropolitan Gas Company, and other companies. Assistance was also obtained in London. So far as expert evidence in matters of dispute with the Alliance Gas Company was concerned, he was the person to supply information to the Corporation. He began his work in life with that Company, and was their Inspector of Lighting. His duties were general inspection of the supply to the consumers, and seeing that the meters and everything appertaining to the supply were satisfactory. At that time he had nothing to do with testing the quality of the gas. His next position was Chief Inspector over the district inspectors; and he was then Superintendent of the offices. Still he had not to bring any scientific knowledge to bear. Witness was questioned as to a dispute between the Directors and the Corporation, in which it was suggested that he carried off the books in order to enable the latter to fight the Company. He denied that he had done this, and said he could produce testimonials as good as anyone could desire of the satisfaction of the Company with his services at the time he left them in May, 1888. Up to that date he had had no experience of using photometers; but from 1865 to 1870 he was continually at the City Hall testing-place, observing the work going on. He did no practical duty in this respect himself; but when, after his appointment by the Corporation, some questions were raised outside as to his competence, he was sent to London by the Lighting Committee to be examined in gas testing, and he had a certificate that his qualification was satisfactory. He then commenced making experiments in testing gas for the Corporation. In 1888, he began to complain of the instruments by which the gas was tested. The Letheby photometer was, he believed, supplied in 1872, and the Evans photometer in 1874. He was told by authorities that the instrument at Burgh Quay in 1888 was not the photometer prescribed by the Act of 1871. He would not swear that it was not.

The CHAIRMAN remarked that whether or not an instrument was one prescribed by an Act was a legal point. Witness had given his opinion.

Mr. GORDON said surely an expert ought to know whether the instrument in use was that prescribed by the Act. The point was one for expert decision.

Cross-examination resumed: They asked by the Bill for four testing-stations. Gas was manufactured at only one place in Dublin. There were two works, connected by a subway; and he wished both were used. He could not give an instance in London, where two testing-places were used for one gas manufactory; but they had mains leading into the testing-station from separate works. If gas passed out by only one main, he considered that one testing-place on the main would be sufficient. If gas was stored in the same holders, but passed out by different mains, one testing-place would not be sufficient, because it was quite possible to manufacture gas of various qualities, and store it in several holders.

Mr. PEMBER: That is not the point. It is not an honest thing to manufacture gas of various qualities.

Witness said they had no right to assume that all the gas delivered in a large city was of the same quality—it would become weak in a certain district, from some cause or other; and the public would not take the Company's word for it. Gas was often manufactured of different qualities when it was not so intended, owing to difference in the coal, &c. Asked as to whether the Corporation would have separate testing-places if all the gas were of one quality, witness said it was their duty to secure proper testing, and they were refused admission to the gas-works when they wanted it. He admitted that when they had an examination made by an expert as to the quality of the gas, he was given the fullest facilities. Witness was questioned as to the approval by himself and the late Lord Mayor of the Tara Street testing-station as sufficient in 1890. He admitted that this was so; and it was on this very site that the station was subsequently erected. As regarded the extra stations for which they wished to provide, he thought both parties would be in very good hands, as the erection of them was to be dependent on the sanction of the Board of Trade. He disputed entirely the statement that the photometers at different stations gave various readings. He was told that in London there were 23 testing-places for 18 gas-works. He was satisfied at the time that the Tara Street station would be satisfactory if the two mains were connected with it; but he had not then before him the report of Mr. West as to the qualities of the gas supplied. He made his report in September, 1889. Counsel proceeded to refer to correspondence between the Corporation and the Company, with the view of showing that witness had for a long period gone on making tests and supplying reports of them to the newspapers, in spite of the position he had taken that the instruments were defective and that accuracy could not be obtained; and he asked witness to give the names of any officials of the Company to whom he had made complaint. Witness gave the name of a Mr. Corcoran as one, and said there were at least three to whom he had made similar representations. Even an uneducated person must,

he thought, see that, when they had no proper means of gauging the pressure at which they made their tests, the results could not be accurate.

Mr. GORDON: When you complained of the gas not being up to the standard, did the Company frequently to your knowledge say: "Test this matter by a summons before the Police Magistrate"?

Witness: Yes; but the Gas Committee looked upon that as an empty challenge, and for this reason: When the instruments supplied were incorrect, of course they struck at the root of the Act of Parliament. The Committee were advised by the Law Agent that if they applied to the Magistrate for a penalty against the Company for supplying inferior gas, they would be at once met by their own statement that the instruments were not correct.

Do you not know that, if the Company attempted to use an instrument that was not in accordance with the Act of Parliament, they would be liable to a penalty?—Yes; I think so.

If they used a correct instrument, and it showed that the light was not up to 16-candle power, were they not liable to it then?—Yes.

Could you not, in either case, proceed against them?—Yes; but our Committee said that the photometer that they had supplied was of such a character that they feared the ordinary Divisional Magistrate would not consider himself competent to decide whether it was a proper instrument or not.

You had to admit that the Company had complied with the terms of the award?—I never heard of such a thing. The Corporation never admitted it.

If they did not, do you not know anything about the proceedings last year before the Master of the Rolls, and that you could have the award specifically performed?—The Corporation endeavoured to get it specifically performed, and, through a mistake on the part of the former Law Agent, we lost our chance. We omitted to make a counterclaim. We made an appeal to the Judge to amend our case; but he would not allow it. We lost our case through the mistake of our Law Agent.

Is there any complaint against you for the way in which you do your work?—No.

Do you remember, in the year 1893, four gentlemen of your own city (one of them being the Lord Mayor) bringing Dr. Tichborne to the testing-place to see how the work was being done, owing to your complaints?—They were not the Committee I was responsible to for the gas-testing—the Gas Committee. These gentlemen belonged to the Paving and Lighting Committee.

Mr. GORDON then read the report signed by James Shanks (Lord Mayor), Robert O'Reilly, John L. Robinson, and R. F. M'Coy (the present Lord Mayor), in reference to a visit to the testing-station on March 21, 1893. It stated that Dr. Tichborne and Mr. Cotton had made tests in their presence, and the former gentleman's observations showed the illuminating power of the gas to be 16·98 candles, while those of the latter resulted in 15·67 candles. The report added that the signatories were of opinion that the Committee should take steps to settle the constant conflict of testimony between the Board of Trade and the Corporation inspectors, as one or the other must be guilty of error; that Mr. Cotton's conduct in the testing-room was not only discourteous, but disrespectful; and that he deliberately set himself to baffle their investigations.

Witness asked Counsel to read his answer to that report.

Mr. GORDON accordingly read Mr. Cotton's reply. It stated that he had offered no opposition to the inquiry, although in his opinion it was without precedent—such work being done by qualified experts. His tests had been performed according to certain rules laid down by the Act of 1871; and if he had acted in the manner required by the Committee of gentlemen who had furnished the report, he would have departed from these rules. He had no intention of offering discourtesy or disrespect to the Committee; and if anything occurred which led them to think he did, he was sorry for it. Counsel also read the remarks of the Paving and Lighting Committee on Mr. Cotton's reply. They were to the effect that they considered the reply unsatisfactory; and they called upon him for an ample apology for his action. Mr. Cotton sent a further reply, expressing his regret that his formal apology had not been considered adequate, and indicating that he was extremely sorry for anything in his action that the Committee considered discourteous or disrespectful.

In further cross-examination, witness said that in the Dublin Corporation there were very strong sympathizers with the Company; two of the gentlemen who formed the Committee being warmest. He suggested that some person of scientific knowledge should be present at the test which had been spoken of; but the Committee which had been formed would not hear of it. Dr. Tichborne's and witness's results of the testing varied; but they had used different photometers. Witness had used the Letheby, and Dr. Tichborne had used the old Evans.

Mr. GORDON pointed out that the Committee had stated in their report that Mr. Cotton's tests were made with the same apparatus; and he asked witness whether he suggested that the present Lord Mayor or the then Lord Mayor and the other two members of the Committee could not tell the difference between one instrument and another.

Witness said he would leave the Lord Mayor to answer for himself. He had never been in the testing-station before; and he was a silent member on that occasion. He (witness) had a misgiving about the whole document, which he believed was specially conjured up to get him into trouble. It was a disgraceful transaction. The gas question in Dublin had been kept back considerably by things of this kind.

Mr. GORDON: Was not Mr. Shanks Lord Mayor of Dublin, and not a shareholder in the Company at all; and I suppose he had some little desire to see fair play?

Witness: He took an antagonistic position all along to the Committee and myself.

Is there a small inner circle of the Paving and Lighting Committee who are irreconcileables on the gas question?—I do not know. The Gas Committee of the Corporation is composed of a number of disinterested men who want to do what is fair and just. They are thoroughly impartial. From the present Lord Mayor, who is Chairman, they would not take the slightest advantage of the Company.

Did not Lord Mayor Shanks express the opinion over and over again that the Corporation were treating the Company improperly and badly?—I cannot say. I know that he was constantly quarrelling with the Gas Committee.

Witness was further cross-examined in reference to tests made by Professor Vernon Harcourt on behalf of the Corporation. He said he did not remember endeavouring to dissuade Professor Harcourt from giving the result of his observations to the representative of the Company.

Re-examined by Mr. PEMBER: He had studied photometry from books for years before he was appointed Gas Examiner to the Corporation. Immediately on his appointment, he went to London, where he tested at several stations night after night. There was nothing in the work that a man of ordinary skill could not learn in a week. The Committee wished him to get a certificate for testing. He submitted himself to the then Superintending Gas Examiner to the Metropolitan Board of Works (now the London County Council), who gave him a certificate of fitness. This was in the year 1888, immediately after his appointment.

Mr. *Hughes*, the Public Analyst and Gas Inspector to the Corporation of Cardiff, examined by Mr. MACINERNEY, said he carried out tests of gas in Dublin on Jan. 27, 1892. The result at the Municipal Buildings was 15·52 candles. In 1894, he made testings at Tara Street and at Sackville Street. The average of four days at Tara Street was 12·77 candles; and that at Sackville Street, 13·47 candles. In March last he made testings at Tara Street on eight days; and the average was 13·79 candles. He made testings on five occasions at Sackville Street; and the result was 15·45 candles. He also made tests at the public station; and the average result was 16·79 candles. On March 19, the result of testing at Tara Street was 14·77 candles; and at the public station, 16·62 candles. Witness gave evidence of other tests, showing the discrepancy between the results obtained at the public station and at others.

Mr. MACINERNEY: Is it correct to say that the testings at the public station were always considerably higher than at the other stations?

Witness: It is, to the extent of nearly 2 candles on the average.

How do you account for this difference?—I account for it by the fact that the instrument they used (the old form of Evans photometer) is favourable to the gas.

In further examination, witness said he considered the alterations which had been referred to as having been made in the Evans photometer had resulted in producing readings favourable to the gas. He thought the public testing-station was badly ventilated, and unnecessarily hot. The tendency of a hot room was to give good results to the gas. While making his tests at the public station, he was subjected to considerable annoyance by people passing through, and by representatives of the Company looking over his shoulders. He thought this ought not to occur. The operation of testing was a very critical one.

In cross-examination by Mr. J. D. FITZGERALD, witness said he did not see how they could make a test which the Company would not be entitled to dispute. When he was asked, after the tests he made, to give the Company a copy of his results, he refused, because he was specially employed by the Corporation to make the tests, and the Company had no right to demand the copy. Certainly Mr. Cotton did not tell him to refuse.

Dr. *Frank L. Teed*, examined by Mr. PEMBER, said he was Public Analyst to two London suburban parishes, one of the Gas Examiners to the London County Council, and an analytical and consulting chemist. He was acquainted with the Alliance Gas Company's Act and with the Gas-Works Clauses Act of 1871; and he had read the terms of the reference and award made in 1889. He had also read the provisions of the present Bill, so far as they related to gas testing. He was of opinion, from the tests made by himself, and from the evidence he had heard that day, that additional testing-stations would give more power of check on the quality of the gas supplied in the city of Dublin. He would suggest four additional stations; but it would be difficult to say whether these would be sufficient. He was aware that there was a power by the Board of Trade to put up more than four stations, which, with the four for which authority was specially sought, would be adequate. He was personally acquainted with the City Hall and Lower Sackville Street stations, and had been on the sites of the others. He thought they were fairly selected. The additional stations were to be made at the expense of the Corporation; and he could not see how the Company would be prejudiced in the slightest degree, however many stations there were, if they were sending out gas of proper quality. He had made tests of the gas at the City Hall, Lower Sackville Street, and Tara Street stations, and also at the official station in Townsend Street. At the City Hall, on Feb. 16 last, from 5.20 to 6.11 p.m., the test gave 14·04 candles; and on the 18th, between 12.10 and 12.24 p.m., a mean of 13·09 candles. Later in the same day—between 6.5 and 6.21—the mean result was 13·90 candles. On the 17th, he made a test at Lower Sackville Street between 5 and 6 o'clock, and brought out the average at 14·53 candles. At 9.45 p.m. on the same day, it was 12·54; and on the 18th, between 1.30 and 2.30, it was 12·73 candles—all these results being considerably below the 16-candle power which the Act required. He was of opinion, judging by experience, that additional testing-places would be required from time to time, in order to satisfactorily examine the gas supplied to the city. The schedule of the Gas-Works Clauses Act, 1871, prescribed either Letheby's or Evans's improved as the photometer to be used for the purposes of compliance with the Act. He was aware that the award of the Arbitrators was that the photometer used in Dublin should be an Evans 100-inch closed. The old Evans now in operation was not really a photometer, and did not fulfil the conditions of the Act. On the other hand, every care was taken, by means of a cone, to provide for the ventilation of the box. Such an instrument as this could not give the proper proportion between the gas-flame and the candle intended by the Act of 1871. It was quite a unique specimen, and ought to be preserved in a museum as an example of the extraordinary fashions of the past. On Feb. 18, he made a series of tests at Tara Street by the Corporation photometer, and also at the official station in Townsend Street on the same day. The tests were intermediate. The mean of the two tests at Tara Street by the Corporation instrument was 13·54 candles; and of those at the Townsend Street official station, 15·50 candles. There

was not the slightest chance of such an instrument as the old "altered form" of Evans being approved by the Board of Trade. He was informed that they would not stamp it.

Mr. LITTLER: Did you take it there?

Witness said he did not; but he knew it would not be stamped.

Mr. LITTLER: Of course, that can be taken as your opinion; but it must not be accepted that it is the decision of the Board of Trade when they have not seen the photometer.

In answer to further questions, witness said he considered that the control of the tests should be in the hands of the Corporation, and not in those of the Company, for the gas examiner was a competent and impartial person. This at least was the definition given of him. The Examiners in London were appointed by the London County Council, except the Chief Gas Examiner, who was appointed by the Board of Trade. On the occasion of his visit to the official station of the Company, there were two of their representatives present. This was not in accordance with the provisions of the Act; and the arrangement was not conducive to accuracy of test, as the Examiner would be likely to be disturbed.

Mr. PEMBER intimated that he could not finish his examination of the witness that day, and suggested that, as he was approaching a fresh subject, it might be convenient to adjourn at that point.

This course was agreed to; and the Committee adjourned until the following day.

Thursday, June 11.

On the resumption of the proceedings this morning,

Dr. *Teed* was further examined by Mr. PEMBER. He repeated that he thought it inconvenient that a good many persons should be present at the station while testing was going on. Under the Gas-Works Clauses Act, gas examiners were appointed by the local authority; and he thought that in this instance they should be appointed by the Corporation. Clause 19 of the Bill provided for daily testing of the gas; and he certainly thought this was necessary. He considered that two tests daily would be sufficient, and would be fair to both parties, in case of any accident which might interfere with the accuracy of one test. He did not think the fact that gas was used during the daytime chiefly for heating purposes was an answer to the necessity for two tests daily, because if it was desired to test the heating capacity of gas, they could not do it much better than by the lighting test. He knew of no instance in which one standard of gas was allowed during the day and another during the night.

Cross-examined by Mr. LITTLER, witness said he had been Gas Examiner in Westminster for the London County Council for about ten years. He believed a slight alteration had been made in his photometer during that time. What he had said about the illuminating power being a good test of heating power was a well-known fact. He was sure this was the case in regard to the incandescent gas-light. He had not heard that anything above 14 candles was not only not required for the incandescent light, but was rather detrimental to it. He had not followed the opinions of other authorities about the incandescent burner, or about heating in reference to illumination; and he had made very few experiments to enable him to say whether 14-candle gas was not absolutely better for heating than 16-candle. Questioned as to whether he knew any place but London which was not under the provisions of the Gas-Works Clauses Act, 1871, he said that Cardiff was not, inasmuch as the Corporation had power to erect testing-stations and test the gas, and to sue for penalties if it should turn out that the gas was below the standard.

Mr. LITTLER: I suggest to you that that is under the Act of 1871?

Witness: The stations are not.

Do you not know that in London there was an extremely anomalous state of things before the passing of the Act?—I have not read the history of the question.

I am sorry for that. What material concession is made to the Company by this Bill? Can you point to any one of its provisions which is of the smallest advantage to them?—Under the present Act, one test is sufficient to condemn theCompany, if the illuminating power is below the standard. Under clause 19 of the Bill, it is proposed to give them an average of two tests.

I do not call that a material advantage. Apart from that, is there any sort of advantage given to the Company by this Bill?—I have not dealt with the question apart from testing. I am not an expert in the other questions.

Is your photometer stamped by the Board of Trade?—I believe not.

Do you know any photometers in use by the Dublin Corporation so stamped, and when they were stamped?—They were stamped when I was there in February of this year. I have no previous knowledge.

Might I suggest that they were stamped just about that time?—I have no information on that point.

What sort of a burner did you use in your tests?—Sugg's No. 5 at the Corporation's station in Tara Street, and Bray's No. 8 at the Company's station.

Was there not a good deal of difference between the two?—Very little.

In further cross-examination, witness said he had heard it stated by gas companies that the same gas would give appreciably different results where the testing-places were some distance apart; but he had never found it so. The tests he made in London as well as in Dublin were chiefly for making a comparison of the standards of light. He had never tested 16-candle gas with the batswing burner; but about March last he tried a series of burners, including the flat-flame, Bray's No. 7, and others. By the "London" argand, on that particular day, the result was 17·3 candles; and with Bray's No. 7, 15·7 candles. The Referees' batswing burner gave 15·9 candles; and Sugg's flat-flame burner, 15 6 candles. The Company were bound to supply gas at proper pressure to all their consumers within 1½ miles radius. In Dublin, the pressure was very good. He should not like to say that, apart from the photometric test, the Company failed to supply gas properly to Dublin; it was difficult to judge by the eye. He would not go so far as to say, from seeing it, that it was bad gas; but it was not gas that the consumer might be fairly expected to be satisfied with, as its illuminating power was so low.

Mr. LITTLER: You say every care seems to have been taken to smother the candles, so as to prevent them giving the normal result in the way of light. What care was taken?

Witness explained, by reference to a diagram, that the apertures for ventilation which should be below the candles were absent. In his own photometer, there were perforated zinc plates 18 inches square; and the ventilation apertures from the bottom were surmounted by a chimney 7 or 8 inches in diameter. He was of opinion that there was not freedom of ventilation for the candles in the Company's photometer. The cone had been placed below the burner; and he thought it was used to concentrate the draught where it was most wanted. He knew it was very much heated, for he had had his hand upon it.

A great many witnesses are absolutely astounded at that statement. Perhaps you would be surprised to find that it was one of the examiners who put on the cone, because it would steady the flame and aid in the proper testing?—I should be sorry for that examiner.

It is no less a person than Mr. Sugg. Do you know the man who made that alteration is the one who made your own machine?

Re-examined by Mr. PEMBER: These instruments were made to order, and there was no cone on his. He knew nothing to match the Company's photometer. If his own was unsatisfactory for testing, of course, its use would be stopped by the Gas Referees. He knew of no burden that would be imposed upon the Company by the Bill. The object was to procure a proper supply of gas to the consumers.

Mr. PEMBROKE STEPHENS remarked that there was a portion of the Bill which provided for reducing the price.

Mr. PEMBER: I did not say in the whole Bill. I said in the clause referred to—the provision of additional testing-stations.

Mr. *A. F. Damon*, the Gas Examiner for the Notting Hill District of London, examined by Mr. MACINERNEY, stated that the old form of Evans photometer showed the illuminating power of gas to be extraordinarily high; and when tested by a modified form of photometer the results fell from 19·6 to 17·5 candles, and from that to 15·7 candles. In 1888, the old form of the instrument was condemned. The photometer used by the Dublin Gas Company was the old Evans. In the one generally employed, both the gas and the candles were ventilated; but in the Dublin instrument the gas only was ventilated. He considered the award of Dec. 16, 1889, meant that the Evans photometer then in use by order of the Gas Referees should be employed, and not the one that had been used some years before. He made some tests with the instrument in Dublin, and they verified his opinion that, the gas being over-ventilated, and the candles not being ventilated, the result was in favour of the Company to the extent of about 2 candles. In London there was an average of one testing-station for each distributing place. It would be necessary in Dublin to have all the mains connected with the testing-stations. He thought four stations a very reasonable demand; and as the Corporation would put them up at their own expense, the Company would have nothing to complain of.

Mr. MACINERNEY: The whole of the apparatus at the station being under the control of the Examiner for the Company, is it possible to make it appear by the test that the gas is of a higher illuminating power than it is in reality?

Witness: It is quite possible; and that is another reason why the purchaser of the gas should have control of the station. As there is a large quantity of gas sold in Dublin for heating purposes, it is desirable that tests should be made during the day as well as at night.

In cross-examination by Mr. GORDON, witness said he did not know of any place in the United Kingdom, except London, where there was testing during the daytime. When the notice was given, the gas examiner made his test openly and above-board; but it was possible that the person in charge of a station could increase the illuminating power of the gas.

Mr. GORDON: Assuming all the gas passed through one main, would it be necessary to have more than one testing-place?

Witness: Decidedly; because the people in Dublin are to get 16-candle gas all over the city; and they have a right to be able to assure themselves they obtain it.

Do you say that if, beyond the distance of 1000 yards within which the testers are placed, the gas supplied were less than 16 candles, the Company should be liable to penalties?—Certainly, the Corporation have a right to satisfy themselves that 16-candle gas is supplied all over the city. The consumers should have what they are paying for.

Assuming that the gas is all one gas, do you suggest that the mere fact that it goes into different mains would necessitate additional testing-stations?—Yes, because it is quite possible for the gas to lose its illuminating power in going through the different mains.

The CHAIRMAN asked what was the cost of the improved form of photometers referred to.

Mr. MACINERNEY said about £70 or £80; and the Corporation proposed to pay for them.

Mr. *W. Chattaway*, formerly one of the Gas Examiners for the London County Council, expressed the opinion that there should be more than one testing-station in a city such as Dublin. He considered, generally speaking, the station of the Company unsatisfactory. He thought it should be better ventilated, and be kept at a lower temperature. On the occasion of his visit in November, 1894, the temperature was 60° Fahr.; and it rose 6° or 7° while they were there. He had made some tests for illuminating power at Tara Street. On Nov. 24, 1894, the mean of two tests following each other was 14·27 candles. On the 25th, the mean of two similar tests in O'Connell Street was 13·22 candles. On the 26th, the mean of two tests at Tara Street was 12·292 candles; and on the 27th, the mean there was 13·59 candles, and in O'Connell Street, 13·29 candles. On the 26th, the mean of the tests at the official station was 16·88 candles. He thought the Corporation should have control of the stations.

Cross-examined by Mr. LITTLER: He considered the photometer in use in Dublin was not what would now be known as an "Evans closed photometer." The one in Tara Street was of a very old type. He was not aware that in Liverpool there was but one testing-station, and that it was the property of the Gas Company. He believed there was only one in Manchester.

Re-examined by Mr. FITZGERALD: He did not understand how the existence of four testing-stations could in any way prejudicially affect the Company. He had never seen the instrument employed.

Mr. *A. G. Vernon Harcourt*, F.R.S., examined by Mr. FITZGERALD,

said he was one of the Metropolitan Gas Referees, and one of the Arbitrators who made the award in the proceedings between the Corporation and the Gas Company in December, 1889.

Mr. FITZGERALD: What do you say was meant by the reference to an "Evans closed 100-inch photometer" in the award?

Mr. LITTLER objected to witness answering this question. He said they could interpret the award for themselves.

Mr. FITZGERALD said the award contained ambiguity as to the description of photometer; and he submitted that this was peculiarly a case where parole evidence on a point upon which so much turned might be given for the information and assistance of the Committee, more especially as it was intended to call in the Arbitrator on the other side, and as the Umpire—Mr. Shiress Will—was available to be called.

Mr. LITTLER pointed out that the words in the award were merely a repetition of those in the Gas-Works Clauses Act, 1871.

The CHAIRMAN said it was the decision of the Committee that the question as to the meaning of the award should not be answered.

Examination resumed: He saw the instrument in use in Dublin before it was put into operation; and he was of opinion that it would not be accepted by the Gas Referees as a photometer. It was not a suitable instrument for testing gas, for the reasons already stated to the Committee. The addition of two or three testing-stations would increase the likelihood of a fine for supplying gas below the standard quality. Except for that, he saw no objection.

Witness put in the results of a number of tests he had made in Dublin.

Mr. *H. A. Hennessey* and Mr. *H. Williamson* having borne out statements made by previous witnesses,

Mr. PEMBROKE STEPHENS intimated that this was all the evidence they would call on that part of the case.

Dr. *Teed*, recalled, said he had tested the gas for sulphur at the official testing-place, and had found 25·96 grains. At Tara Street, the same day, he had found 26·26 grains; and on the following day, at the same place, 29·24 grains. The limit for sulphur was fixed at 20 grains per 100 cubic feet of gas.

Mr. *Cotton*, recalled, and examined by Mr. GERALD FITZGERALD, stated that, under the Company's Act of 1883, the maximum price that could be charged was 4s. 1d. within the city; 4s. 4d. in Rathmines, Pembroke, Blackrock, and Kingstown; 5s. elsewhere. The present charge in the city was 3s. 5d.; in certain of the townships, it was 3s. 8d.; in part of the county, it was 4s. 6d. At one place, two different prices—3s. 5d. and 4s. 6d.—were charged for gas out of the same pipe, because the consumers lived on different sides of the road. The Corporation now proposed that the standard price should be 3s. 4d. During the last ten years or so, it had been noticed that more gas had to be used by consumers in order to obtain the same quantity of light; and he was clearly of opinion they did not get full value for the money paid.

Mr. FITZGERALD: What is the value of a candle per annum on 16-candle gas in Dublin?

Witness: I can only approximate from my knowledge of many years past. I should say that within the City of Dublin the money paid by the consumers will be from £150,000 to £160,000 a year. That being so, I take the value of one candle to be about £9000. It must be between £8000 and £10,000 a year.

Do you produce a table showing the cost of gas in Dublin as compared with other large towns?—Yes; it refers to the year 1894. The figures of 1895 only reached me yesterday. In Plymouth, the price of gas in 1894 was 1s. 9d. per 1000 cubic feet; and the quality was 14·85 candles. This has been increased this year to 15·5 candles; and the price is the same. The price is 96·4 per cent. lower than in Dublin. In Bristol, the price of gas was 2s. 8d. in 1894, and was reduced last year to 2s. 6d.; the quality being 16¼ candles. That price is 42 per cent. less than in Dublin. In Sheffield, gas was sold in 1894 at 1s. 10d.; but I think the average would be 2s. 1d. The quality is more than 18 candles. The price in Sheffield is 1·27 per cent. lower than in Dublin. The price charged by the South Metropolitan Company was 2s. 4d. in 1894, and last year I believe it was reduced to 2s. 3d. The quality of their gas is 16·40 candles; and the price is 62·9 per cent. less than in Dublin. In Dublin, the average quality of the gas supplied, according to about 1300 tests made during the last three years, has been about 14 candles. Next I come to the gross profit made by each of these Companies. On the gas sold per 1000 feet, the Plymouth Company are satisfied with 5·38d.; the Bristol Company, with 12·29d.; the Sheffield Company, with 13·10d.; and the South Metropolitan Company, who are dividing 13 per cent. (a larger dividend than the Dublin Company), with 12·24d. The Dublin Company, for every 1000 cubic feet sold, irrespective of quality, have obtained for some years 17·99d.—a profit of 1s. 6d. on every 1000 cubic feet of gas sold to the consumer. The cost of coal in 1894 was: In Plymouth, 12s. 9d. per ton; in Bristol, 10s. 2d.; in Sheffield, 8s. 6d.; the South Metropolitan Company paid 10s. 6d.; and the Dublin Company, 15s. 8d. in 1894 and 15s. 2d. in 1895. With regard to working expenses per ton of coal, they were: In Plymouth, 8s. 4d.; in Bristol, 9s. 11d.; in Sheffield, 12s. 6d.; with the South Metropolitan Company, 11s. 11d.; and with the Dublin Company, 12s. 7d. The quantity of gas unaccounted for in Dublin is much higher than in any of the places I have named. In Plymouth, the loss was 6·34 per cent.; in Bristol, 8·16; in Sheffield, 6·08; with the South Metropolitan Company, 5·94; and in Dublin, 10·66. The capital employed in Dublin per ton of coal is very excessive. The Corporation and the citizens believe this is due to want of energy on the part of the Company in not selling more gas. They have one set of gas-works lying derelict; and if they were put into operation, it would give immense employment in Dublin. But the policy of the Directors is to maintain a high price for gas. The contention of the Corporation is that the gas ought to be sold at a lower price, and that if the Directors had adopted this policy many years back, they would have doubled their sale. I say the price is prohibitive.

The CHAIRMAN: Well, say the price is prohibitive, if you like; but do not enter into what the Gas Company ought to do. It is not for you to say that.

Mr. LITTLER (in cross-examination): Who, in your judgment, is the more likely person to manage an affair—the one to whom the property belongs or an outsider?

Witness: The person to whom the concern belongs is the best one, no doubt, to manage it; but those to whom the article is supplied are the best judges of whether or not they are paying too much for it.

In further cross-examination, witness admitted that he did not know anything about the inner working of the Corporations of the towns he had mentioned, nor how the Companies had been able to sell gas at a comparatively cheap rate.

Friday, June 12.

On the re-assembling of the Committee this morning,

Mr. *Cotton* was further cross-examined by Mr. LITTLER, who put before him statistics of the number of consumers per mile of main in Plymouth and Dublin respectively. Witness stated that in Dublin the number was only 26 per mile, as against 176 at Plymouth. On being asked if this was not explained by the fact that the more wealthy class of consumers had ceased to have houses in Dublin at all, and that the buildings formerly occupied by them were now tenement houses, the occupiers of which did not use gas, he said he did not believe that Dublin was decaying in such a way as that. A greater number of people of the middle class, not the better class—the aristocracy—were living outside Dublin than used to be the case.

Mr. LITTLER: Is it not a fact that a large number of people are escaping from Dublin because they are not enamoured of the general management of affairs by the Corporation?

Witness: No; I have never heard that.

Cannel coal is required to enrich the quality of gas. Do you know any company who use so much cannel coal as the Dublin Company for 16-candle gas?—No; not for 16-candle gas.

Do you contend, or do you not, that we ought to have no means of testing gas supplied for purity, for illuminating power, or for pressure, which are not in accordance with the Act of Parliament which governs us?—I do contend that the Company should not have the means of testing the gas in the public stations.

The CHAIRMAN: Please answer the question put by the learned Counsel. Your Counsel will have the opportunity of re-examining, if he thinks it necessary to do so.

Witness: I do contend that you ought not to have the power.

Do you contend that if we in the past have complied with the Act of Parliament, we have been failing in our duty?—I said you had failed in your duty.

Mr. LITTLER: Do answer my question, or I shall really have to sit down. I ask the shorthand writer to read the question I put to you.

Witness still hesitated; and the question was read by the shorthand writer a second time.

Witness said he would not contend that the Company had failed in their duty if they had complied with the Act.

Mr. *J. Hutchinson*, the High Sheriff for the City of Dublin, said that for the past 25 years there had been complaints as to the price of gas; and if this had been lower and the quality higher, the consumption would have been greater. He was present at the Corporation meeting, under the Borough Funds Act, in relation to the Bill. The meeting was unanimously in favour of the Bill, and expressed the opinion that Parliament should be applied to to settle the long-standing differences between the Corporation and the Company.

Cross-examined by Mr. PEMBROKE STEPHENS: It was a fact that, during the 25 years over which the complaints had extended, the price and quality of the gas had been settled by agreement between the Company and the Corporation; and the general feeling was that the arrangements were unsatisfactory, and that Parliament should settle them once for all. He was a consumer of gas; but he had not sent any complaint to the Company, nor did he know anybody who had. There was a general complaint as to the state of things existing.

Re-examined by Mr. MACINERNEY: The object of the Bill was to secure that consumers should have gas of proper quality. The people of Dublin had always been in favour of the gas and water clauses of the Bill. He did not say that the selling price of gas was fixed by agreement with the Corporation.

Mr. PEMBROKE STEPHENS: The standard selling price never is.

It being intimated that this concluded the promoters' case,

The CHAIRMAN asked Mr. Macinerney whether he intended to call the Lord Mayor of Dublin.

Mr. MACINERNEY: He expressed his desire to be examined at the close of the proceedings.

The CHAIRMAN: We will give our decision on Part III. (the gas clauses) as we did on Part II. (the water clauses) at the close of the evidence on that part. Counsel will quite understand that, unless the Lord Mayor gives his evidence now, his evidence will be on Part IV. (the miscellaneous matters) of the Bill.

Mr. MACINERNEY said that the promoters were content that the evidence already given should complete the case.

The room was then cleared. On the re-admission of the parties after an interval of a few minutes,

The CHAIRMAN said the Committee had decided that it was not expedient to proceed with Part III. of the Bill.

The remainder of the Bill was then dealt with, and further considered on the following Monday, when it was ordered to be reported.

Matlock Bath Gas Bill.—A Committee of the House of Lords, under the presidency of the Earl of Northbrook, had before them last week the Bill promoted by the Urban District Council of Matlock Bath and Scarthin Nick, for the purchase of the Matlock Bath Gas Company's undertaking. The Committee proceedings in the Lower House have already been reported (see *ante*, pp. 869, 922, 985); and those now under notice resulted in the passing of the preamble on Friday. On the consideration of the clauses, an amendment proposed by the Company to the effect that the arbitration should take place under the Lands Clauses Acts was rejected by the Committee. Application was made by the Company for the costs incurred in connection with their Provisional Order, which, as notified in our "Progress of Bills," is not to be proceeded with. But the Chairman characterized it and the inquiry before the two Committees as "perfectly monstrous;" adding that their Lordships regretted that expense should have been incurred in going to the Upper House after the decision in the Commons.

HOUSE OF COMMONS COMMITTEE ON THE LONDON WATER BILLS.

Tuesday, June 9.

(*Before Sir* J. PEASE, *Chairman; Sir* J. BRUNNER, *Mr.* BALDWIN, *Mr.* BOND, *Mr.* J. STUART, *Mr.* BRIGG, *Mr.* FRY, *Mr.* LEES KNOWLES, *and Mr.* MUNTZ.)

STAINES RESERVOIRS BILL.

Before the public were admitted into the room this morning, the Committee remained for upwards of an hour in private deliberation. When the doors were opened,

The CHAIRMAN said: I have to apologize for having kept the Bar and others waiting; but there are several important points that naturally arise in so difficult an investigation as this. At present, of course, we do not commit ourselves in any shape or way either to passing the preamble of this very important measure or the reverse. But we thought it would save time and trouble, and shorten the case very materially, if upon one or two points we at once gave an opinion, which may be argued upon or spoken upon hereafter. In regard to the sinking fund, I have to announce that we are unanimous in the feeling that it will be necessary to apply the sinking fund clauses to the whole of this undertaking, or to any part of it which may be passed if the preamble is proved. Having come to this conclusion, of course there is a great deal which is involved upon that mere statement—particularly the discovery of some true and proper method of adapting the decision to the wants and interests of the three Companies separately. Looking at the question as a whole, we have thought that the sinking fund will have to be applied to this undertaking, as well as to all other Water Bills which have during the last year or two been brought before Parliament. This is what I may call an intermediate intimation; and we may as well now go on with the evidence for the promoters.

Mr. *Collins* was then cross-examined by Mr. BALFOUR BROWNE. He denied that most of the sources of increased consumption which he had described the previous Friday had existed the last 19 years. He did not think that he enumerated them before the Royal Commission; though he probably had some of them in his mind.

Mr. BALFOUR BROWNE: Nothing has happened since then in relation to the consumption of water, has there?

Witness: Yes; there has been a great increase in the street-washing supply.

How much is that increase?—It is very considerable, although I have not got the exact figures with me. I could not say whether it would be a quarter of a gallon per head of the population.

Is it not the fact that in 1895 the water resources of London were severely tried, particularly in the East London Company's district, and found wanting?—I believe so.

And is it not the fact that in that year you had no scarcity yourself, but actually sold water to the East London Water Company?—We gave a full supply to the whole of our customers, and assisted the East London Water Company in addition.

In your case, now, you are relying upon road-watering; but I find that in the table you submitted to the Commission, you put down road-watering, sewer-flushing, and so on, at 0·87 per cent. of your whole supply?—Yes.

As Distributing Engineer, you have a great deal to do with the prevention of leakage; and you have endeavoured to find out where the leakage takes place?—Yes.

And your experience has been that there is an immense amount of water per head absolutely wasted?—I should hardly say wasted.

Well, there is an immense leakage. There is a large quantity of water supplied which is unaccounted for?—I do not think leakage takes place to an abnormal extent in our district. There must always be considerable leakage in connection with a water company of this kind.

Witness went on to say that no doubt if all waste were stopped, the necessity for providing a further supply of water would be obviated—at any rate, for the present. The consumption her head per day was 27·9 gallons.

Mr. BALFOUR BROWNE: Do you think that is an ample supply per head of the population.

Witness: It was ample in January.

And ought it not to be ample at any other time?—No.

What would be an ample supply?—I should say that we ought not to have less than the amount stated before the Royal Commission as necessary—namely, 35 gallons per head per day.

Is it not a fact that 3 million gallons per day would be saved if waste was properly prevented?—No doubt that would be saved in ordinary times. We have storage reservoirs; and they are necessary to enable us to meet extraordinary demands.

Assuming you have suddenly to meet a large demand for water, if you had to double your supply would it be easier to do it by calling on your storage or by sinking fresh wells?—We must have water storage for distribution; we cannot call sufficient wells into existence at a moment's notice. Our storage reservoirs at present are sufficient to enable us to meet a temporary increased demand, but not a doubling of our usual supply.

The CHAIRMAN: Did I understand you to say that your supply was given on the rateable value of the houses in your district?

Witness: Yes.

And that you do not make an extra charge for baths or water-closets?—For houses of a rental of £30, we do not make any further charge. Our charge is 4 or 5 per cent. on the value, according to the height of the district. In houses of from £35 to £40 a year rent, baths are a new feature within the last eight years.

By Mr. STUART: The case of the district in which the supply averaged 78 gallons per head per day was an isolated one. It was a district in which there was a large amount of water used for garden purposes. In fact, generally where the consumption was greatest was where there were large gardens. But in St. Luke's, Shoreditch, and other places, where there were practically no baths and no gardens, the supply was only from 22 to 23 gallons per day.

In re-examination by Mr. LITTLER, witness said it was very difficult to ascertain the population the Company were supplying. The estimates the Company made were no more than estimates. No doubt it was not a proper excuse, when some one was short of water, to say: "Oh! but see there are other people who are using too much." The New River Company had assisted other people with water; but by the year 1900, they would not be able to do so. Their present resources would be exhausted; and they would want water for their own consumers.

Mr. LITTLER said that he now proposed to call Mr. Searle, whose evidence would show the Committee the difficulty there would be in applying the sinking fund clauses to this Act.

Mr. *James Searle* stated that he was Secretary to the New River Company, and had been so for 15 years. He was, in his official position, well acquainted with the requirements of the Company; and in his view, an additional supply of water was urgently needed by them. Supposing their present appliances were worked to the utmost, the greatest supply they could give would be 46 million gallons per day. It was a fact that the Company laid between three and four miles of new mains every year, for supplying districts freshly built upon; and this, in itself, involved a very considerable capital expenditure—about £10,000 per annum. In regard to the history and position of the New River Company, he might say that it was established in 1618 by Charter of James I. The benefit and profits were to be divided into two moieties—one to go to the King and the other to Hugh Myddelton and his adventurers rateably. The moiety of the latter was divided into 36 parts; and by the Charter every adventurer not possessed of a 36th part was to be removed from the governing body. The property had always been regarded as real estate, transferred by conveyance, and registered in Middlesex; and it had been dealt with, not like share property in a commercial undertaking, but as undivided shares in a landed estate. Provided that the share was not too small to produce the proper annual value, it gave a freeholder's vote for Herts and Middlesex. In course of time, it had happened that a number of adventurers' shares had been divided into fractions. Many of them were held under trusts and other conditions. Tenancies for life had been created; and, in every respect, the property in the New River Water Company was as unlike the shares in an ordinary commercial undertaking as could possibly be conceived.

In the reign of Charles II., the King's moiety was sold to Mr. A. Myddelton, in consideration of the payment of £500 per annum, which was still paid, not to the Royal exchequer, but to some private person who held the right. The King's moiety was subsequently also divided into 36 shares. Nothing very definite, however, was known about the Company in these early times; for their books had been destroyed by fire. But the whole undertaking had been divided into 72 parts—36 Adventurers' and 36 King's parts.

The CHAIRMAN: Are the King's shares now held by private parties, like the others.

Witness: Certainly.

Mr. LITTLER: But the holders of the King's part have no share in the management?

Witness: Not the slightest. Continuing, he said that the King's shares had become subject to the same complications as the Adventurers' shares. Whenever a fraction was sold, the conveyance had to be produced in order that the Company might know to whom the proportional part of the revenue had to be paid; otherwise they had no concern in the details of the division of the shares. All the Company required was the production of the conveyance, entitling a particular person to a certain amount of money. There were meetings of the Company in the ordinary sense. No votes were necessary at meetings; and those who had the necessary qualification were *ipso facto* part of the governing body. Every holder of an Adventurer's share was a member of the governing body. There were 28 members now. The number was fixed at 29 when the Company was incorporated; and that was never exceeded, even though more persons might be qualified.

The CHAIRMAN asked if there was any record of what the capital terms expended had been?

Witness replied that there was no record since the destruction of the books. In 1852, it was estimated that the amount of capital stood at some £1,509,958; a parliamentary inquiry held in 1815 having, on the evidence of two capable engineers, fixed the value of the works then in existence, at £1,000,000 in round numbers.

The CHAIRMAN: That is the capital the Deputy-Chairman referred to when he said that the 72 shares were worth over £100,000 each.

Witness: Yes. A considerable portion of the capital was spent 300 years ago, when a pound went much farther than it does to-day. The only capital used in modern times has been £500,000, which was obtained in 1866 in £100 shares. By Acts of Parliament passed in 1852, 1854, and 1857, the Company were authorized to borrow £1,000,000 on bond, with restrictions on the rate of interest. They were then authorized to convert their bond debt into a permanent debenture stock, bearing a maximum rate of interest of 5 per cent. They converted the £1,000,000 at 4 per cent.; and in 1879, a further £500,000 of debenture stock was authorized, at 4 per cent. Profits are divided over £2,019,958. The owners of the Company have 500 acres of estate in Clerkenwell which have nothing to do with water supply. At the beginning of the century, it was mostly let on building lease. To show the difficulty of dealing with the shares of the Company like ordinary shares, I may mention that some of the proprietors have redeemed their land-tax, while others have not. The interest paid is £12 11s. 6d. per cent. on the nominal sum of £2,019,958, of which 4s. 3d. is due to the real estate account. The Company have overspent their capital to the extent of £78,000. They do not enforce their maximum rates on any of the water consumers, but charge considerably below them.

In cross-examination as to the possibility of forming a sinking fund in connection with the Company, witness said the estate and the water accounts were kept separately. He did not think there would be any difficulty in apportioning between the three Companies the expenditure which this Bill would involve if passed.

In reply to the CHAIRMAN, witness said there were between 600 and 700 shareholders in the Company.

Sir *F. Bramwell*, M.Inst.C.E., who was the last witness called by the promoters, gave expert evidence as to the feasibility of the scheme of

the Bill. He maintained that a much larger quantity of water than was at present abstracted could be taken from the Thames without mischief. There was nothing in the Bill which could injure the river when it was at its minimum flow; but the provisions would enable the Company to arrest the excess water which at present went into the sea, and was wasted. The proposal contained in the Bill would form an instalment of the scheme submitted to the Royal Commission for the adequate supply of London with water from the Upper Thames; and bearing in mind the future of London, he did not think it would be an unreasonable instalment. They had to provide against accidents of drought and frost, rare though they might be. They were bound, in the interest of the inhabitants of London, to take care that, come what might, they should be ensured a proper water supply. This Bill was preferable to allowing London to ruin itself by plunging into a Welsh water scheme, which would require some 15 years to carry out. The plan the measure contemplated was excellent in itself, and would prove in every way economical.

In cross-examination, witness said that in 1872 he had been party to a scheme for obtaining water for London from the chalk; but he did not now favour that idea. Thames water was purer now than it was in those days; pollutions having been stopped. He did not think that 35 gallons per head per day was too much water to allow to the population of London, though he had held a different opinion when giving evidence before the Royal Commission. Subsequent events had shown him that he was mistaken in his former estimate.

In reply to Lord R. CECIL, witness said he did not think that to pass this Bill would commit Parliament to the whole of the Staines scheme which was put before the Royal Commission.

In re-examination, witness stated that he was of opinion that water for London of excellent dietetic quality might be procured from the Thames for the next hundred years. That was Dr. Frankland's opinion, and with it he agreed.

At the conclusion of Sir F. Bramwell's evidence.

Mr. POPE said that, though the promoters had other expert evidence which they could call in support of their proposals, they wished to shorten the inquiry as much as possible. That, therefore, would be their case.

Wednesday, June 10.

On the resumption of the proceedings to-day,

Mr. FITZGERALD, who appeared on behalf of the Thames Conservators, said that his clients up to this had taken no part in the case, owing to certain negotiations which had been going on between them and the promoters. They had always viewed the Bill with apprehension, but had thought it possible that their objections might be removed. Unfortunately, this result had not been achieved; and they were now as strongly opposed to the measure as anybody else. It had been arranged that, if the negotiations to which he referred came to nothing, the Engineers of the promoters should be re-called, in order to be cross-examined on behalf of the Thames Conservancy. He would now, therefore, request that Mr. Hunter should be re-called, so that certain questions might be put to him, to show that the opposition of the Conservators was quite as real as that of the County Council.

Mr. POPE said that Mr. Hunter, who was Engineer of the Grand Junction Water Company, and also to the scheme of the Bill, was not present, but was at his office at Bow. There had been certain negotiations which had to be considered by the Engineers of the promoters the previous night, and in regard to which, in the ordinary course, a statement would have been sent to the other side next morning. It was manifest that there could be no possible opposition to the Bill on the part of the Thames Conservancy.

Mr. FITZGERALD: On the contrary, the opposition is of the strongest character.

The CHAIRMAN said that, as Mr. Hunter was not present, Mr. Middleton might be examined, seeing that he was quite as responsible as, if not more so than, Mr. Hunter.

Mr. *Middleton* was then re-called; and, in cross-examination by Mr. FITZGERALD, said that 149 million gallons per day would be the possible intake of the Water Companies under the Bill, including the powers they already possessed. It was proposed, not only that the promoters should store water at the Staines Reservoirs, but also that they should send it down the aqueduct direct to the reservoirs nearer London, and to the works of the Companies. The capacity of the aqueduct was only 60 million gallons per day; and therefore the Companies would be limited to taking that amount. But, of course, if they obtained unlimited powers of abstracting water from the river, it would only then be a question of coming to Parliament hereafter for authority to enlarge the aqueduct. They proposed, however, up to the year 1911, which was the date given as the limit, not to take more than 60 million gallons a day from the river, though there was nothing in the Bill to bind them.

The CHAIRMAN pointed out that the Committee had heard from the Counsel on the other side that they were prepared to limit themselves to 100 million gallons a day.

Mr. POPE remarked that this proposal had been made to the Committee—to Parliament itself.

Mr. FITZGERALD said that the question he was addressing himself to was whether 100 million gallons could be taken as a daily supply, as opposed to storage. (To witness:) Was there anything to prevent the Companies selling the surplus water they might have to other Companies?

Witness: Nothing.

Therefore it does become important to see what amount of water you can take, because, in addition to supplying your own district, you may sell to other Companies?—That is not our intention.

But as the Bill stands it could be done?—If you can find the water, it can be done.

The CHAIRMAN said the whole quantity of water the Companies could take was 130 million gallons; and the actual amount taken was 110 million gallons. How could they sell their balance to people who could procure the water for themselves?

Mr. FITZGERALD replied that if the powers sought were granted, they would cover a period in the future when a much larger amount of water would be required. He was pointing out that, as the Bill stood, there was nothing in it to prevent the Joint Committee from selling the water they had power to take to other Companies.

Witness said there was nothing in the proposal laid before the promoters by the Thames Conservators to prevent this being done.

Mr. FITZGERALD: Are you willing, as representing the promoters, to be prevented from doing it?

Witness: To a certain extent, yes. We will limit ourselves to 100 million gallons for supply and storage, or a daily average throughout the year of 45 million gallons.

Are you willing to be limited to a certain supply per day, with no power to sell the surplus?

Witness said that question had better be put to someone else. What water they had a right to take from the river, and did not want to use themselves, they might, under the Bill as it stood, sell to other Companies; and no doubt to that extent the Joint Committee would be the first mortgagees of the water which came over the Bell Weir.

Mr. FITZGERALD asked witness if he had calculated what the Companies ought to pay the Conservators, if the contribution they made was based on the proportion of the amount they were now paying and the water they were taking?

Witness said he had nothing at all to do with the financial question, and had made no calculations.

Mr. POPE called attention to the preamble of the Thames Conservancy Act of 1894—the first statute which recognized payment by the Water Companies to the Conservators as a statutory obligation. He asked witness if it did not say that, having regard to the large quantity of water from the Thames used for domestic purposes in the Metropolis and suburbs thereof, and the constant increased pollution, and circumstances of pollution, in the area of the river, it was desirable that the power of the Conservators for preventing pollution be extended, and that provision be made for increased payment to the Conservators?

Witness replied in the affirmative. The object of the Bill was to give the Conservators up to the source of the river the powers they had exercised previously within a limited area. The payment made by the Companies was for the benefit they received in the prevention of pollution; and the Companies were prepared to contribute what the Committee might think reasonable and fair, to any additional extent which might be necessary in order to secure greater purity of the water in the river.

A long and animated argument here took place as to the order in which the cases of the opponents should be presented to the Committee. It was clearly laid down by Mr. Pope that the senior amongst the Counsel opposed to the Bill could elect his position; and in that case Mr. Fitzgerald, as representing Mr. Fletcher Moulton (who was the senior), elected to come last. To this Mr. Worsley Taylor, Mr. Milvain, Lord Robert Cecil, and others objected, not on the question of bar etiquette, but on the general principle of convenience; holding that the cases of the London County Council, the City of London, and the other local authorities interested could not be presented until that of the Thames Conservators had been submitted. It was stated that the Conservators were *quasi* promoters of the Bill—a suggestion which Mr. Fitzgerald warmly repudiated. The Chairman desired to leave Counsel to settle among themselves the order of presenting the petitioners' cases; but as this appeared impossible, and as there seemed to be some difference of opinion among the members of the Committee themselves—with whom the statement had weight that the case of the other petitioners could not be adequately presented, from engineering points of view, until the attitude of the Thames Conservators towards the promoters was understood—the room was cleared, and the Committee remained for some time in private deliberation. On the re-admission of the public,

The CHAIRMAN said the Committee had decided that, though they did not wish to interfere with the rule of the bar in the present instance, it was necessary, for the convenience of the Committee, that the case of the Thames Conservancy Board should be taken first.

Mr. *C. J. More*, the Engineer to the Thames Conservancy Board, was then called by Mr. FITZGERALD. He said the six large Metropolitan Water Companies had power to take 130 million gallons of water per day from the river; but, as a matter of fact, they took more than this during the summer months. They had abstracted as much as 140 million gallons in a single day—a serious thing when they bore in mind that the flow of the river had sunk, in a particular day in 1887, to as low as 180 million gallons. At Teddington, the summer flow had sunk to 200 million gallons, or less. The Companies at such periods had not taken the full quantity they were entitled to; otherwise the flow of the river would have been greatly reduced. To his mind, the Companies should not be allowed to increase the amount of their daily intake from the river. It was absolutely essential, for the protection of the river below Richmond, that 200 million gallons should flow daily over Teddington Weir. If this amount did not flow, the current of the water would be reduced. The navigation below the locks depended upon the land water when the tide was out. He considered that Penton Hook would be a better place to measure the flow of the river than the Bell Weir. The amount which should be left to flow at Penton Hook—above which the River Colne came in—was 300 million gallons per day.

The CHAIRMAN said it was difficult to go into these matters particularly, as the Committee had been given to understand that the question between the Thames Conservators and the promoters was one, not of principle, but of price.

Witness said that not more than 45 million gallons per day should be taken down the proposed aqueduct No. 1.

In cross-examination by Mr. POPE, witness said he would rather have the flow of the Thames preserved to 300 million gallons below Penton Hook than 200 million gallons over Teddington Weir. The 300 million gallons below Penton Hook would give some 235 million gallons over Teddington Weir. The Conservators did not want the Joint Committee to take more than 45 million gallons of water per day, because that was all they said they required. If the whole of the water the Conservators had to dispose of were taken by the Committee, there would be none left for other Water Companies who might want an increased supply in the future. Of course, it was necessary that the Conservators should be paid by the Joint Committee for whatever water was abstracted, in consideration of the expense the former were put to in keeping up the weirs and purifying the water. For an

increased supply of water, the Companies should pay an increased contribution to the Conservators.

Mr. FITZGERALD then addressed the Committee for the Thames Conservators. He said he felt that the position of his clients had been prejudiced by the remarks which had been made in the course of the inquiry as to the negotiations which were taking place between them and the promoters. The Conservators had objections to the Bill; and at one time it was hoped that their objections would be met. This result did not, however, appear to have been secured. The Conservators thought that it was at Penton Hook that the flow of water in the Thames should be measured. Moreover, they objected to clause 42 of the Bill; believing that if, in the future, some other Water Company should desire to take more water from the Thames, they would have to be postponed until the Joint Committee were satisfied under the powers conferred upon them by the Bill. The promoters suggested that they should be bound not to take more than 100 million gallons of water on a single day, though they were willing to agree that the total annual amount they should take should be 45 million gallons multiplied by 365. For this quantity, the promoters would receive a preferential claim. A vested interest would be created; and whenever any other Water Company came and asked for water, the Joint Committee would say: "Parliament has given us this right." That would be quite unfair, so far as the other Companies were concerned; and no case for doing it had been placed before the Committee. He asked, therefore, that, whatever powers were conferred on the promoters, the Committee should insert a proviso declaring that all water taken under the Bill should be used by the Companies who were parties to the measure solely for their own supply. If the Bill passed in its present form, even with a limitation of the kind he suggested, the West Middlesex and the Grand Junction Companies would be able to sell whatever water they could take from the Thames under the existing powers. To this he objected; and for the protection of the other Companies, he suggested that a clause should be inserted in the Bill declaring that if, in the future, other Companies came for more water from the river, they should have rights *pari passu* with those of the promoters of the present measure. This would prevent the promoters from using the Bill to the prejudice of the Thames Conservators and the other Water Companies. Taking it roughly, the contribution made by the Water Companies was very much, though not exactly, in proportion to the quantity of water taken. The West Middlesex and Grand Junction Companies each took 24½ million gallons of water, and each made a contribution of precisely the same sum—namely, £4678—to the funds of the Thames Conservancy, to be applied in the way directed by Act of Parliament. These two sums amounted to £9356; and in respect of that, they had a right to take 49 million gallons of water per day. Under the Bill, they would be entitled to an additional 45 million gallons; and if this quantity was taken, he submitted that the Companies should pay a proportionate amount to that which they were now paying.

Sir J. BRUNNER: Are the expenses of the Conservators increasing?

Mr. FITZGERALD: Yes.

Mr. STUART: Increasing in consequence of the larger amount of water which was being taken from the river?

Mr. FITZGERALD: No; but I am told that the income of the Board is insufficient to enable them to carry out the necessary works.

The case of the London County Council was next proceeded with.

Mr. *W. H. Dickinson*, formerly Deputy-Chairman of the Council, and at present Chairman of the Water Committee of the Council, explained the attitude of that authority on the water question.

The CHAIRMAN remarked that it was not necessary to go into an historic account of the action and views of the Council.

Mr. WORSLEY TAYLOR said it was necessary to go into this very briefly, in order to put a connected story before the Committee. The Council did not wish to introduce a rival scheme to the Committee.

Witness (continuing) described the case put before the Royal Commission by the London County Council; pointing out that the Commission had only to consider whether the amount of water in the Thames was sufficient for the supply of the Metropolis; and of good enough quality. They were not appointed to inquire as to whether a better system of supply could be found. The Water Committee of the Council had been charged with the consideration of the whole question without limitation; and, of course, they had the report of the Royal Commission to assist them in their deliberations. The Committee disagreed with the scheme of which the proposal in the Bill was put forward as an instalment; and in January of the present year, at the request of the Council, they reported with reference to the Bills before the Committee. It was then decided unanimously that the Council, while divided as to what authority should be entrusted with the administration of the water supply—a matter which could only be decided by Parliament—were of opinion that the water supply should be under public control, and not in the hands of the private Companies. It was resolved to petition against the Bills of the Companies, and oppose them in so far as they were prejudicial to the interests of the ratepayers and the consumers, having special regard to the policy of the Council. Subsequently, the Committee reported that it was not wise to depend upon the Thames and the Lea for the future water supply of the Metropolis, and that a Welsh supply from the valleys of the Usk, the Wye, and the Towey should be resorted to. The Council, in effect, endorsed the report of the Committee. A Parliamentary Committee recommended that the water question should be considered by the County Council as a whole, and dealt with by purchase and the revision of the control of the Companies. The Council had, accordingly, considered the whole matter, and were practically in a position to formulate, if required to do so, a definite scheme for dealing with the London Water Supply. They were of opinion that the latter question ought not to be prejudiced by any intermediate Bills for the benefit of the Water Companies. They considered that the two solutions of the subject should be considered as a whole; the one matter being the storage scheme, and the other a supply of water from another source. No doubt, if there was a chance of water famine, some steps should be taken to provide against it; but they should only be of a temporary character.

Mr. WORSLEY TAYLOR asked witness if he would explain his view of the Bill before the House.

Witness replied that the County Council had unanimously resolved to oppose the Bill; and the Water Committee of that body had had the question of the opposition before them constantly. Whatever statement he might make as his own opinion, he was justified in saying was shared by the Committee. The views of the Council would be found in the petition before the Committee. The objection to the Bill was that the scheme was not only not one for meeting the immediate wants of the Metropolis, but the initiation of a plan for the total supply of London based on the suggestion contained in the Royal Commission's report. It would practically commit London to obtaining its future water supply from storage reservoirs on the Thames—and that without Parliament having any opportunity of considering any alternate proposal. The Bill, in its preamble, approved of the report of the Royal Commission, and stated that the scheme would be an "instalment of that great plan." The Bill would prejudice the question of the purchase of the Water Companies, and also that of the source of the water, and dealing with the water at its source. If the storage scheme was the right one, it should not, in his opinion, be put before Parliament in this piecemeal fashion as an instalment. Taking the figures of the Companies which were before the Committee, if they were also applied to those which were not parties to the Bill, provision would have to be made for a supply of 700 million gallons of water per day, and not for the 450 million gallons dealt with in the report of the Royal Commission. He did not think the Royal Commission would have come to the decision they did, if they had had these figures before them.

The CHAIRMAN: You do not agree with these figures, but are simply measuring the Companies by their own figures?

Witness said that was so. The Council were of opinion that, when a large scheme was put forward by the Companies, Parliament should take the opportunity of revising their charges, their system of paying dividends, and the contract by a public authority. The proposal in the Bill was to set up a new Water Company entirely; and that was not the right way to solve the question, even if the Companies were left in possession. The Council asked that only the immediate pressing necessities of the public should be considered. It would take the Companies five years to carry out their scheme; and, in his view, temporary provision should not be made for more than two years.

By the CHAIRMAN: It would take the Council eleven or twelve years to put their Welsh scheme into operation; and as to what should be done in the meantime, in reply to the contention of the Companies, he would say that there was no pressing need for a further supply now, and whatever need there might be in the future could be met by enabling the Companies temporarily to increase their intakes from the Thames.

In reply to Mr. FITZGERALD, witness said he did not think that any payment should be made to the Conservators for water taken out of the Thames. The prevention of pollution was an expenditure which should be borne by the ratepayers, according to the benefit they derived. Any payment made to the Conservators would be a tax on the consumers now, and certainly would be so when the Companies were purchased.

Thursday, June 11.

Mr. *Dickinson* was this morning recalled and cross-examined.

Mr. POPE: Do you agree with me that, in all this discussion, the paramount interest to be considered is that of the water consumers?—Certainly.

Will you go so far as to agree with me that the consumers, who *bonâ fide* want water, and will pay for it, ought to get it?—Certainly.

And that involves, does it not, a provision for the maximum amount required, and not for the average amount?—You cannot deal with the question except on the footing of averages.

Might not provision be made for the maximum amount required at any given time, and not for the average amount?—Yes, but the question is not the maximum.

Having ascertained the maximum, that, at least, ought to be provided?—That which is really wanted should be provided.

For how long—until you or some other body can get other water in exchange?—Oh, yes.

And how long will it be, in any event, before the County Council can get water to give to the consumers?—I think that in two years' time, at the outside, the Bill might be brought before Parliament; and such a scheme, I presume, would take into consideration all the needs, both ultimate and immediate, of the consumers. The necessary additional supplies of water might be provided for up to the year 1903.

How?—By following in the steps you were proposing, I should say that the worst we could do would be to follow your example; we think we could do much better.

How many years must elapse before you can do that which you think would be better?—Supposing the question is how to supply people who will be in existence between 1903 and 1910, the problem could be solved without any water famine by a scheme which the County Council or the Water Board, if it were established, could bring before Parliament in the next two years.

Would it be economical to adopt a hand-to-mouth scheme?—If the true solution of the problem in London is not to adopt the plan suggested by the Royal Commission, it would be economical to bring in a temporary scheme, to supply whatever water might be required for the next three years, so that a more elaborate permanent system might be adopted in the future. I say that the worst we could do would be to accept your scheme.

But you might be driven to it?—I do not think so.

What is the alternative?—That is a question for the Engineer; but if we are going to Wales for water, I do not think it would be wise to embark upon this scheme of the construction of storage reservoirs.

You would take increased powers to acquire water from the Thames when it was wanted, which would be when it could spare it least, and when its condition was worst?—That again, I say, is a question for the Engineer. The point to be dealt with is, how to use the existing powers of the Companies to tide over the period of difficulty, while arrangements are being made for the establishment of a satisfactory permanent supply.

In reply to further questions, witness said that, in his opinion, some

body or other would have to provide for the water supply of London during the 15 years it would take to carry out the Welsh scheme.

Re-examined by Mr. BALFOUR BROWNE: No doubt the person to be first considered was the consumer—neither the County Council nor the Water Companies came before him. Once having ascertained what the requirements of the people were, they ought to be met. But it did not follow that, because a Company were supplying 48 gallons a day per head, that was the amount needed by the public.

Mr. BALFOUR BROWNE: You do not think that there will be a water famine within the next ten, or even fifteen, years?

Witness: No; we are advised that such a thing is not likely to happen.

Are there some Water Companies that are not taking their full quantity from the Thames?—Yes; the Chelsea Company, for instance, are only taking 10 million gallons, whereas they have a statutory right to take 22 million gallons.

If there should be a great want of water in London, might not the Companies requiring it be empowered to take that water which the Chelsea Company are not using?—There is no reason on earth why they should not. We say that there is not likely to be a water famine; but, suppose we are wrong, there are certain ways of meeting the difficulty, either temporarily by taking water out of the Thames, as is done at present, or by the adoption of some more permanent works, such as those proposed in the present Bill. We believe that the carrying out of the suggested scheme, which will involve an expediture of a million pounds, will be, in effect, forestalling the action of the County Council.

In reply to further questions, witness stated that, though he did not believe there would be a water famine, even if there were the consumers could get water under the plan he suggested quite as good as that supplied by the Companies. If the County Council were not sure that the water consumers were safe, and believed that the only method of making them so was that proposed by the promoters, they would not object to the Bill.

Mr. *A. R. Binnie*, M.Inst.C.E., Chief Engineer to the London County Council, was the next witness. He said he had given attention to the report of the Royal Commission, to which so much reference had been made; and he had also had to consider very carefully the future requirements of London in the matter of water. In doing so, he had divided the subject into two main portions—the first, as to the requirements in the immediate future; and the second, as to providing a large increase, amounting to more than double the present supply, which was pointed to by the Royal Commission. The Commissioners had looked a great deal ahead; and they had fixed the year 1931 as the limit of the requirements, which they thought should be provided for. The figures they gave, in paragraph 70 of their report, for the year 1931, were 415,219,752 gallons a day. According to them, that was what the consumption would be in 1931; the supply in 1891 being taken at 171,163,385 gallons—showing that the Commission believed that there would be an increased consumption in 40 years of 244,056,000 gallons, or an increase of 142 per cent. As to the supply of London with water up to the year 1931, no decision had been arrived at by any competent authority. In the meantime, the Government had introduced what they called the Metropolitan Counties Water Board Bill, which included a proposal for the control and purchase of the Companies, for the providing of a new supply, and so forth. Under these circumstances, he was of opinion that nothing should be done which would prejudge or fetter the new authority, if it was established. If it did not come into existence, the duty would revert to the London County Council; and he did not wish that body to be fettered more than any Water Board that might be created.

The CHAIRMAN: You must always keep in mind, Mr. Balfour Browne, that the Committee are only to deal with those things which cannot be postponed without detriment to the public interests.

Mr. BALFOUR BROWNE (to witness): Then I will ask you, do you think the scheme in the Bill can be postponed without detriment to the public?

Witness: Most decidedly.

The CHAIRMAN: That is the whole point we have to settle.

Witness, in further examination, went on to give minute details as to the rate of supply per head, and the probable requirements of the Water Companies in the future. He pointed out that a previous Commission, presided over by the Duke of Richmond, in 1869, laid down the consumption per head at 31·8 gallons per day according to one reckoning, and at 32 gallons according to another. The subsequent Commission, however, found that in 1891 the consumption per head was 32·68 gallons per day. This showed that there was very little increase between 1869 and 1891. Witness, however, thought that 35 gallons per head per day was the least that should be provided; and in the tables he had prepared to show that there was no necessity for this scheme, he had adopted this quantity. There had no doubt been a marked increase in the consumption of water by the people of London since the sitting of the last Royal Commission. It had been estimated that between 1893 and 1894 an increase of 11 per cent. over the consumption in 1891 had taken place. There had been no marked increase in the population of London over the increase in 1891 during recent years; so that the 11 per cent. increase in the consumption of water between 1891 and 1893-94 was not due to any cause of that kind. In 1867, when the Duke of Richmond's Commission first sat, there was no constant water supply in London; but a change in this respect had been carried out since, which must have had a considerable effect in the direction of increasing the consumption of water—not the use altogether, but the consumption, for a large percentage of the increase was due to leakage, which took place while the pipes and fittings were in process of alteration or change. He pointed out that last year there was what was called a water famine in London; and it had been made the subject of a Board of Trade inquiry. There had also been an inquiry after the frost of 1895; and the reports which had been submitted as a result, showed that a great waste of water occurred, due to leakage through damage to mains and pipes. The reason was that the mains were laid at too little depth; and the remedy, of course, was to put them further underground. Steps had been taken to prevent the recurrence of the difficulties of 1895. It was only fair to say that, in the case of the Grand Junction and some of the other Companies, the pipes were well laid, and there was comparatively small loss of water through bursts. All the London Companies, however, suffered from this loss more or less. Witness went on to show that the Companies had inter-sale powers, which would enable them to sell to each other any surplus water they might acquire over and above that which they might need for the supply of their consumers. The Southwark and Vauxhall Water Company had power, by agreement with the Thames Conservancy, to take 24 million gallons of water from the Thames. They drew more than this, but contended that they had a right to do so, as the overdraught came from the gravel and not from the river. He estimated that the unexhausted rights of the Water Companies, so far as Thames water was concerned, would give them 26 million gallons of water per day; and that the resources at their command would furnish them with water sufficient, at 35 gallons a head per day, for the supply of 3,428,200 people—the number actually supplied at the present moment being 2,699,515. Dealing individually with the three Companies who were parties to the Bill, he said he had never heard a complaint against the New River Company's supply. They not only had enough water for their own purposes, but in the year of difficulty they had been able to sell some to the East London Company. They had not exhausted their rights of intake from the River Lea; and they had for years waived certain rights, by allowing water to flow past their intakes for a money consideration from the East London Water Company. He mentioned this as showing the resources of the New River Company. The Company had not spoken of the desirability of their having power to take water from the Thames when they were before the Royal Commission; this being the first time they had ever asked authority to take Thames water. He put in tabulated statements, based on the figures presented by the Companies, demonstrating that, according to their own showing, the three Companies had ample water to last them for years to come. So far as the West Middlesex Company were concerned, their requirements could be met by means of sale to them, or certainly by overdraught of water from the Thames. In regard to the Grand Junction Company, it had been admitted by Mr. Hunter, their own witness, that they would be satisfied if they had power to increase the amount of water they took from the river. The Staines district he had been familiar with ever since he was a boy; and he certainly did not think it was a fit site for large storage reservoirs, nor did he think the proposal for an open conduit a good one. The scheme before the Committee had been put forward on the recommendation of the Royal Commission.

Mr. POPE: None of their Counsel have said so.

Mr. WORSLEY TAYLOR: The preamble of the Bill states it.

Mr. POPE: No; it says that the scheme will form an instalment of the proposal submitted to the Royal Commission.

Witness said the present scheme differed from the one submitted to the Commissioners. The proposal as laid before the Commissioners was based on abstracting water from the Thames above the Bell Weir. Nothing was said about taking it from the river below the Weir in the neighbourhood of the junction of the Colne with the Thames; nor was anything said about carrying water from Staines in an open aqueduct. The water was always spoken of as being carried through pipes. The Commission only approved of the Staines scheme on certain definite and clearly laid down lines, which included regulations as to the taking of water and its treatment after being abstracted from the river, because they said it would require to undergo certain processes before it was fit for consumption. They themselves did not feel competent to go into detail on these subjects; but they thought that Parliament should institute a searching inquiry, and sanction rules which should be rigidly observed. The Bill did not contain any of the conditions to which he referred.

Mr. WORSLEY TAYLOR: So that, according to the report of the Commission, the scheme had to be carefully considered as a whole. (To witness:) What do you say about the site?

Witness: I say it is not a suitable one.

On what grounds?—It is in a district which is far too populous. It is near a large sewage farm; and there is also a large public establishment close by (the West London School), which drains down towards the open conduit. The fall of the land is from north to south, towards the conduit.

The CHAIRMAN: It will be concreted?

Witness said the promoters talked of the conduit being concreted; but as the scheme had been so altered since they came into the Committee-room, he could not speak about it exactly.

Mr. WORSLEY TAYLOR: The attention of the Local Government Board has been called to the general character of the land of the district, has it not?

Witness: Yes; and they reported in March 1891. They said that the condition of the district was a matter of more than local concern; and that besides the rain that fell on the surface, water passed through the gravel, and, owing to the porous nature of the gravel and the rapidity with which liquid passed through it, thousands of cesspools were dug in it for purposes of drainage. The drainage from these cesspools found its way into the river, and flowed to the intakes of some of the London Water Companies. I do not think the construction of storage reservoirs and an open conduit at such a place can be a good thing.

The Commission stated, in effect, that, broadly speaking, and without committing themselves to details, they might say that the conception of the Staines storage scheme commended itself to them as the best plan of the kind which had been suggested. But is this one of the matters which were not before the Committee, and which, according to their own declaration, required to be looked into?—Yes. The Commission gave their approval of the Staines scheme in very guarded words. This open conduit is to be 8 miles long, to carry water at a depth of 5 feet, and discharge 100 million gallons a day. If the conduit is 15 feet wide at the bottom, it will discharge 100 million gallons a day; but I assume, from what was said yesterday, that in part of its length the channel will not be so wide.

What will be the effect of frost on a conduit of this length without obstruction?—Water 5 feet deep, running 2 feet per second, would soon get blocked with ice. I have walked over the river in the neighbourhood many times when it has been frozen. In regard to the summer, the water flowing at the rate I have mentioned will take six hours to run the length of the conduit. It will be exposed to the sun, and will

get heated. Drinking water should not be exposed in this way; and it should not flow in an open conduit through a district so thickly populated. I have seen every water scheme which has been proposed in this country during the past 30 years; but I have never before known of a proposal made to bring water to a large town in an open conduit through a thickly populated district. Not only are the Birmingham and Manchester and all other large conduits covered in through the thickly populated districts, but also through the wildest and most mountainous places. Then the embankment of the conduit will be very objectionable. That is a feature which has only been made public since the section and plan have been hung on the wall. The embankment will be from 4 feet to 8 feet above the level of the land, and will act as a barrier to the flow of flood water into the river. We shall find that a great deal of opposition will be offered to the Bill on this ground in another place, if it is passed here. The promoters seek powers which will enable them to leave only 220 million gallons of water in the river; and this they do without making a proposal for the supply of compensation water. So far, the gaugings made of the water flow have not been adequate, nor has there been a sufficient inquiry into the probable effects of the scheme.

The Committee then adjourned till the next day.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Friday, June 19.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* KAY *and* A. L. SMITH.)

The Incandescent Gas-Light Company, Limited, v. The De Mare Incandescent Gas-Light System, Limited.

The hearing of the appeal from the decision of Mr. Justice Wills in the above-named case (see *ante*, p. 872) commenced to-day.

Mr. BOUSFIELD, Q.C., Mr. WALLACE, Q.C., and Mr. C. E. E. JENKINS appeared for the appellants; Mr. MOULTON, Q.C., Mr. TERRELL, Q.C., and Mr. WALTERS represented the respondents.

Mr. BOUSFIELD said he appeared on behalf of the appellants, who were the defendants in an action tried before Mr. Justice Wills for infringement of a patent relating to a mantle for incandescent gas lighting. The action was brought for an injunction to restrain the infringement of letters patent No. 15,286 of 1885. The defence was, mainly, "non-infringement." There was also a question raised as to the validity of the plaintiffs' patent, chiefly on an issue which was gone into at some length—whether a process mentioned in the patent would give practical results. All the issues were found in favour of the plaintiffs; and he was not proposing to appeal from any one of them except that of infringement of the patent. The Court would not be troubled with long technical and complicated portions of the case, which had reference to the question whether or not the plaintiffs' process would, in fact, result in a useful object.

Lord Justice KAY remarked that the patent must be taken to be valid.

Mr. BOUSFIELD said that was so. The sole question was whether there had been an infringement of the patent.

The MASTER of the ROLLS said he had no doubt the appellants would raise every point upon this issue.

Mr. BOUSFIELD thought not. Very possibly he might refer to the evidence of prior knowledge to some extent, but only slightly. His clients had never contended that, on the ground of anticipation, the patent was bad, but only, having regard to what was known before, if the Court interpreted it so widely as to bring the defendants in as infringers, then they would include something which was old. After explaining the difference between mantles manufactured by the plaintiffs and by the defendants, the learned Counsel called the attention of the Court to the plaintiffs' specification, which he said had been described in the Court below as a "pioneer" patent.

Lord Justice KAY asked, if there were other metals which would give the same effect as those used by the plantiffs, why they were not equivalents.

Mr. BOUSFIELD said the plaintiffs had given evidence that it was known at the date of the patent that there were certain metals which would produce incandescence.

Lord Justice KAY said he understood the appellants had taken zirconia, and the substance which contained a trace of yttrium; but they left out lanthanum.

Mr. BOUSFIELD intimated that this was so.

Lord Justice SMITH asked whether it did not all amount to this: Was erbia an equivalent for zirconia?

Mr. BOUSFIELD thought this was the whole point.

Lord Justice KAY inquired whether the light was due to the presence of zirconia or to other rare earths, or whether it was due partly to the one and party to the other.

Mr. BOUSFIELD said the light was chiefly due to the lanthanum or the yttria. The zirconia furnished some of the light; but its chief use was to strengthen the mantle. If they tried to make a mantle with yttria alone, it would be so fragile that the very slightest vibration would make it tumble to pieces. If made with thoria, the mantle would be rigid and brittle. If made of alumina, they would get a splendid flexible mantle, but it would not give any light; whereas if made of zirconia, they would have a tolerably good mantle with a fair amount of light. Before the date of the plaintiffs' patent, the mixture of magnesia and zirconia in the shape of a solid lump in the oxy-hydrogen flame had been used. The plaintiffs said there were forty metals, every one of which treated alone would give a different result as regards the coherence of the mantles and their endurance and the amount of light (which was important), and also the colour of the light.

Lord Justice KAY: Do you say a material part of the patent is a combination of two things?

Mr. BOUSFIELD: Yes—lanthanum and zirconia.

Lord Justice SMITH: Instead of lanthanum, you say you use cerite earth?

Mr. BOUSFIELD said that was so.

The MASTER of the ROLLS inquired whether Mr. Justice Wills had held that the defendants used cerite earth?

Mr. BOUSFIELD replied that he held that they had neither used cerite earth nor lanthanum.

Lord Justice KAY asked which of the two had most effect on the lighting quality.

Mr. BOUSFIELD replied that it was lanthanum. Cerite earth was not, he said, a chemical expression at all. It was translated from the German, and meant earths of the mineral cerite.

The MASTER of the ROLLS asked what it was the appellants proposed to do.

Mr. BOUSFIELD said they intended to make mantles founded on zirconia, but with magnesia and erbium.

The MASTER of the ROLLS asked whether the witnesses for the plaintiffs said this was the same thing as they used.

Mr. BOUSFIELD replied that they said the invention was for taking any rare earth and blending it with zirconia. The real question was: What was the ambit of the plaintiffs' specification? It was of importance that an inventor who had made an invention of value should get all the favour which the law could give him; but it was also of importance to the public that the specification should state clearly what was the ground he intended to mark out as his own.

Lord Justice KAY said a patent might be confined to three things, and if a person took one of them, that would be an infringement in the eye of the law. He understood the appellants to say that "equivalents" must mean things known as equivalents at the time.

Mr. BOUSFIELD said this had already been decided by the Court.

The MASTER of the ROLLS asked whether the equivalent used by the appellants produced the same results as that of the respondents.

Mr. BOUSFIELD said it did not; but it produced an incandescent body.

Lord Justice KAY: Does it give as much light as the other?

Mr. BOUSFIELD: No.

Lord Justice KAY: Did Welsbach know that the substances you use produce the same effect, though perhaps not in the same degree?

Mr. BOUSFIELD: He knew that erbia was an incandescent body, and gave a greenish light upon incandescence. He knew that if a mantle were made of it it would hold together and give a skeleton. [The learned Counsel then proceeded to call their Lordships' attention to the evidence given in the Court below, and read the judgment of Mr. Justice Wills, commenting upon it occasionally.]

Lord Justice KAY said he could see exactly what was in the learned Judge's mind. He considered the essence of the invention was turning the salts of these rare metals into a fabric by using first of all a cotton fabric which was burnt out, leaving only a skeleton of the oxides of the metals, and using this as a means of increasing the lighting power of a gas-flame. The "prescription" included lanthanum; and the defendants were not proposing to use lanthanum. But the prescription was only a part of the thing. The essence of the thing was using the oxides of the rare metals to produce the hood.

Mr. BOUSFIELD said he thought this was an accurate summary of the view the learned Judge took; but he submitted that the vice of it was that it looked to what was the essence of the invention at large, without troubling about the way in which the inventor had claimed it, and seeing how the claim was limited. The public had to look to the specification to see what was the substance of the invention; and there it plainly appeared that lanthanum was an important part of the substance. But his Lordship came to the conclusion that lanthanum was not important, and might be omitted, and yet the substance of the invention would be taken. The learned Counsel went on to develop this argument as he read and commented upon the further portions of the judgment; and he then quoted and commented upon previous decisions, particularly *Dudgeon v. Thomson*, *Clark v. Adie*, and the Nobel Company's case. This, with continual interruptions from the Bench, occupied the remainder of the day; and when the Court adjourned, Counsel was just about to read the judgment of Mr. Justice Wills in the Sunlight case, which he submitted was inconsistent with his decision in the case under appeal.

The hearing is to be resumed on Tuesday (to-day).

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, June 17.

(*Before Justices* CAVE *and* WILLS.)

Queen v. Gibson and Others (Justices) and the Birkdale District Council.

The question raised in this case was whether the Magistrates for the county, sitting at Birkdale, had jurisdiction to hear a summons against the Southport Corporation for having supplied to the urban district of Birkdale gas which was not of the illuminating power and quality provided by the Southport Improvement Act, 1871. The Magistrates came to the conclusion that they could hear the case (see *ante*, p. 987). Thereupon the Corporation of Southport, who are the owners of the gas-works, applied for, and obtained, a rule *nisi* for a writ of prohibition (see *ante*, p. 1176). This rule now came up for argument.

Mr. HORRIDGE appeared to show cause against the rule; Mr. MACMORRAN, Q.C., and Mr. J. S. GREEN supported it.

Mr. HORRIDGE argued that the offence in question was alleged to have been committed outside the borough, and that therefore the Borough Justices could not adjudicate upon it.

Mr. MACMORRAN, in support of the rule, contended that the summonses must come before a Petty Sessions held in the borough of Southport, in which case they would be heard by a tribunal composed of Borough and County Justices together. He said he should be content with an expression of the opinion of the Court that the Borough Justices had a perfect right to sit at Birkdale to hear these summonses.

Justice CAVE: The Borough Justices cannot sit outside the borough. Therefore you have to go the length of saying that this inquiry could only be instituted in the borough.

Mr. MACMORRAN said he did say so. His contention was that the Act provided that such offences as were complained of should be decided before two or more Justices assembled and acting together in Petty Sessions for the borough. It was never intended to give exclusive jurisdiction to the County Justices in matters of this kind, but to give it to them conjointly with the Magistrates of Southport. What he said was that they ought not to sit alone, and outside the borough, otherwise any Justices of Lancashire could sit and decide this matter in Birkdale.

Justice CAVE: There is nothing to prevent their doing so, except their own good sense as to not interfering with matters which do not concern the districts in which they usually act.

After further argument,

Justice CAVE said it was abundantly clear that the County Justices had jurisdiction to hear these cases; and therefore the rule must be discharged.

Justice WILLS concurred.

The rule was accordingly discharged, with costs.

The Gas Supply of Birkdale.

At the Birkdale Police Court last Thursday, the above subject was again brought forward. The Magistrates' Clerk (Mr. J. Smallshaw) stated that the rule *nisi* obtained by the Southport Corporation against the District Council had been discharged on the previous day, with costs, in London. This left the case yet to be tried by the County Justices at Birkdale. The Town Clerk of Southport was willing that it should be adjourned till next Thursday. Mr. Gibson (who was in the chair) asked if this was agreeable to both parties; and on being informed that it was, the case was adjourned to the day named.

Claim against the Staffordshire Potteries Water Company.

At Hanley recently, a case was brought before His Honour Judge Jordon in which Sarah Myatt and her husband claimed £5 6s. 8d. from the Staffordshire Potteries Water Company under these circumstances: The Company supplied water to six houses at Bucknall, of which Mrs. Myatt was the owner; and in February last, one of their Inspectors, on visiting the premises, found a leakage going on. According to the plaintiffs' case, the Inspector thereupon left a notice with the tenants for the renewal of the piping to the six houses; the notice stating that the strength and weight of the piping then in use was deficient. The notice further stated that the water supply would not be turned on again until the pipes had been renewed. This notice was forwarded to Mrs. Myatt by post; and she at once took measures to have the work carried out. The piping supplying the six houses was uncovered and taken up by a labourer in the plaintiffs' employ. Mr. Davonport, an authorized plumber, then proceeded with the new piping. The excavations had already been made for the new piping, when he found that the old was apparently of the same strength as the new. A piece of it was cut off and taken to the offices of the Company. On seeing it, the Engineer of the Company (Mr. G. D. Harrison) said it was all right; and he added that "a man must be a fool to take up such lead as that." The old piping was thereupon re-laid; a small piece only which had burst being renewed. The present claim was to recoup the plaintiffs for the expenditure to which they had been put through, as they alleged, the negligence of the defendants' agent. Among the witnesses was Mr. Harrison, who said the piece of pipe brought to him by their Inspector in February last, when the supply was cut off, was a 4-lb. instead of a 6-lb. pipe. It was a very unusual thing for a 4-lb. pipe to be used along with a 6-lb. pipe; and the inspector would conclude that it was all 4-lb. Henry Espley, who served the notice, corroborated as to the deficient strength of the piece taken out. He took the sample, he said, 18 inches from the main; and it was very defective through leakage. His Honour held that the Inspector was justified, when he found the 4-lb. piping, in assuming that the whole of it was of the same strength. It was impossible for him (the Judge) to come to the conclusion that he had been guilty of negligence when he traced the leakage and found this piping, which had been wrongfully placed there by some other plumber, he had no doubt, at a time when there had been a leakage. In his opinion, he was perfectly right in serving the notice; and the real cause of the plaintiffs having been put to this expense was through a plumber having previously done his work improperly. A verdict was accordingly given for the Company, who did not ask for costs.

Fatal Accident at the Huddersfield Gas-Works.—Last Wednesday an inquiry was held at the Huddersfield Infirmary into the circumstances attending the death of Thomas Frith, aged 50 years, a fireman, who died that morning from the effects of injuries received at the Corporation Gas-Works, the previous Saturday. Deceased had been employed at the works for seventeen years. According to the evidence, the unfortunate man at the time of the accident was engaged in pricking up and removing clinkers from a furnace, when the bars gave way, the hot coke dropped into a water-tank underneath, and he was severely scalded by the resulting steam. The retort-house in which the accident occurred was erected some eight or nine months ago. The Engineer and Manager (Mr. W. R. Herring) informed the jury that the furnace was simply one of some sixty similar furnaces; and it was the man's duty to report any defect which existed. His (witness's) opinion was that Frith in using the pricker caught the bearer-bar with a sufficiently hard knock to not only push it from the brick-work, but to force it towards the back of the furnace, where it was found. The bearer-bar would be from 1½ inches to 2 inches square, of wrought iron, and 1 ft. 9 in. in length. It was embedded in fire-brick work 4½ inches on either side and cemented. Dr. Crosland deposed that the cause of death was exhaustion, following on the burns. The Coroner (Mr. J. E. Hill) said it was probable that the bar came out of its bearing because of a little extra strength used by the deceased with the pricker, which weighed 1¼ cwt. He thought deceased had died from burns received by the accidental giving way of a bar. A verdict to this effect was returned.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS SUPPLY.

The Annual Accounts.

We have received from Mr. John S. Gibb, the Treasurer of the Edinburgh and Leith Gas Commissioners, an abstract (subject to audit) of the Commissioners' accounts for the year ending May 15 last. It is as follows:—

Surplus on the year's working		£38,803 16 8
From this has to be provided—		
For Annuities	£33,782 10 0	
Amount transferred to the sinking fund in respect of annuities redeemed	217 10 0	
Do. do. in respect of mortgages redeemed	139 15 0	
Interest on mortgages, &c.	4,502 8 6	
Expenses of mortgages	59 3 6	
		38,701 7 0
After meeting these charges there remains a balance of		£102 9 8
Adding amount brought forward from the year 1894-5, after deduction of contributions to sinking funds, &c.		47,032 8 0
Makes total at credit of profit and loss account		£47,134 17 8
This is subject to the statutory minimum charges for sinking funds as follows:—		
For repayment of money borrowed	£1303 19 8	
For redemption of annuities	7217 5 4	
		8,521 5 0
Leaving a balance of		£38,613 12 8

This balance may be dealt with at the discretion of the Commissioners in terms of their Act.

THE GAS COAL CONTRACTS OF THE GLASGOW CORPORATION.

Within the last three or four weeks, the Glasgow Corporation Gas Committee have advertised for offers for coal supplies for the new financial year; the quantity wanted being put down at 500,000 tons. The tenders sent in were considered by the Sub-Committee on Contracts during the past week, and sundry offers were accepted in whole or in part. It is said that the number of offers received from colliery proprietors and coal merchants was between eighty and ninety; the quantities in the tenders ranging up to 50,000 or 60,000 tons. Although statements have appeared in two Scotch papers to the effect that the purchases made reach 500,000 tons, the whole quantity wanted, we are assured on good authority that this is really not the case, as the bulk contracted for at present does not exceed 403,000 tons; the opinion of the Contracts Sub-Committee being that it would be more politic to defer making the rest of their purchases till the month of September. It is understood that they have not yet bought any really first-class cannels or rich shales; and they will, in all probability, be included in the second, or September, buying. Report has it that all the rich cannels were offered at very decided reductions in price, ranging from 1s. to 5s. per ton under the prices at which the same coals were purchased last year. Only one lot of rich cannel—not a first-class kind—was bought; the amount being some 20,000 tons. Two lots of second-class cannel were included in the purchases; one being a lot of 30,000 tons, and the other amounting to twice this quantity. On cannels of this sort, there is a reduction in price ranging from 3d. to 6d. per ton. Third-class cannels remain at the same price as was current at this time last year; and in this department purchases have been made in lots of 5000 to 10,000 tons. "Whole-seam" coals have been bought in lots ranging from 10,000 to 50,000 tons, and at a few pence less per ton than the prices prevailing a year ago. Report also has it that one firm of colliery proprietors whose offers in past years have ranged up to 50,000 or 60,000 tons of "whole-seam" coal have on this occasion been thrown out. In another case, a firm of colliery owners whose contracts have been on the books for well-nigh thirty years (frequently getting acceptances for 30,000 tons), could not offer this year, in consequence of their inability to come to terms with the landlord in regard to the renewal of their lease of the coal-field. The Glasgow Gas Committee continue to go in more and more extensively from year to year for coking splint coals, of which they have purchased large quantities this year, as they get a fair price for good coke. In this department, purchases range from 5000 to 20,000 tons. Splints and "pugs" have been bought at about 6s. 5d. per ton delivered at the nearest gas-works. Most of the coals just purchased will be supplied from collieries in Lanarkshire; but the source of supply also includes Fifeshire and Ayrshire, as on many former occasions.

RAMSGATE CORPORATION GAS AND WATER ACCOUNTS.

Proposed Extensive Use of Incandescent Gas-Lights.

The Gas and Water Committee of the Ramsgate Corporation met yesterday week to receive the annual statement of the accounts of the departments under their care. The Mayor (Mr. C. J. Gwyn) moved the adoption of the report, and, in doing so, said the total amount expended on the fixed plant account during the year was £1560, which left the capital overdrawn to the extent of £1984. As to the revenue account, although more gas had been made, the expenditure on coal was £186 less, due to improved working. Purifying materials were £56 more, owing to the increased quantity of gas dealt with; wages had decreased by £44; and repair and maintenance of works had advanced by £66. The total excess on distribution amounted to £188. The principal increase on the expenditure side was in rates and taxes, which amounted to £731 more; this being due to the excessive assessment of the works by the Union authorities last year. The total

expenditure amounted to £20,543, against £19,678 last year. On the credit side, the sale of gas was £3196 less; the difference being made by a reduction of 6d. per 1000 cubic feet at the commencement of the year. The rental of meters was £19 more; and the residual products realized £1093 less, divided as follows: Coke, £779; breeze, £28; and sulphate, £346—all owing to the reduction in the market prices of these residuals. Tar showed an increase of £60, owing to the better contract obtained during the year. The result of these reductions made the revenue of the department £27,255, as against £31,484 last year. The gross profit for the year was £6712, to be carried to the profit and loss account. The loan charges and payment for interest came to £5160. This included the sum of £1364, which had been paid off loans during the year. In last year's account, the corresponding amount was £717. As the Committee were aware, during the next few years the arrangements would necessitate larger payments on this account. Deducting £5160 from the gross profit, left the net profit for the year on the gas undertaking at £1552. The reserve fund, including interest, amounted to £4777; and it was fully invested in Consols. Alluding to the adoption of incandescent gas lighting, his Worship said there were, in round figures, 900 public lamps in the town, which would cost £1 per lamp for fitting up. It was proposed, after the front and principal streets were lighted, to go on with the others until the whole were completed. It was suggested that £300 per annum for three years be set aside to cover the cost. As to the water accounts, his Worship said that the amount expended in the year on fixed plant was £637 on account of new mains; the principal main under this heading being that laid to Haine. This left an amount of unspent capital in hand of £523. The sale of water had increased by £762 during the year. The principal part of this was due to the new assessment list in operation; three-quarters of this year's accounts being charged on the revised assessment. Maintenance amounted to £3591, as against £3327 last year; coal being £113 less, and the various items for repair and maintenance of works and mains rather more. As in the gas department, the principal increase in this account was rates and taxes, which were £246 in excess of last year. The balance carried to profit and loss account for the year was £5569. In last year's accounts, the gross profit was £4699; but before arriving at this amount, the sum of £500 had been placed to the depreciation fund. Under their new Provisiona Order, this fund was done away with; and therefore, to compare the two years, they must take last year's profit as £5199 as against £5569 this year. The loan charges amounted to £4352; and deducting this from the gross profit left £1217 as the net profit for the year. The sum of £890 was during the year carried to the general district fund account by order of the Committee. As in the gas account, £1119 had been paid off capital in the course of the year, compared with £405 in the previous year. The reserve fund, including interest, amounted to £3947, and was fully invested in Consols. In conclusion, his Worship pointed out that during last year the following amounts were handed to the consumers from the gas and water undertakings: Amounts paid to district rate, £3266; rebate to consumers, £2847; reduction of 6d. per 1000 cubic feet of gas, £3736—total amount from gas undertaking, £9849. Adding the £890 paid to the district fund from water account made £10,740. The report was adopted.

THE GAS SUPPLY OF BINGLEY.

The Annual Accounts.

At the Meeting of the Bingley District Council on Monday last week, the accounts of the gas undertaking for the year ending March 31 last were presented. They showed that the quantity of gas made was 81,513,200 cubic feet, of which 73,730,500 cubic feet were sold. The coal carbonized was 8084 tons; the gas produced being equal to 10,083 cubic feet per ton. The sale of gas realized £10,494; the quantity consumed by cookers, &c., was 12,170,000 cubic feet, producing £1419 16s. 8d. net; and the value of the residuals (equal to 52 per cent. of the cost of coal) was £2169. The gross profit was £3426; the net profit, £1515. The amount in the reserve fund brought forward was £946; adding the £1515, made up £2461. From this, £310 was withdrawn; leaving £2151. In the previous year the gross profit was £3062; the net profit, £998. The Chairman of the Gas Committee (Mr. Gatecliff), in moving the adoption of the minutes, mentioned that the leakage had increased from 5·86 to 6·03 per cent., owing to the extra pressure upon the mains. There had been complaints about people not having sufficient pressure to run gas-engines, or use cookers satisfactorily. The Committee had inquired carefully into all the cases; and found that it was not a question of pressure at all. The complaints arose from either faulty services, fittings corroded by age, or services too small. On the financial statement he had put the quantity of gas manufactured from March to March. The coal carbonized gave a result of 10,083 cubic feet to the ton—an increase of 380 cubic feet upon the previous twelve months. For many years the statements to the gas consumers had been sent out at the half years ending June and December; but all the calculations regarding production and management of the works were taken from March to March. This was an anomaly. The gas made from December, 1894, to December, 1895, was 78,992,100 cubic feet; but from March, 1895, to March, 1896, it was 81,513,200 cubic feet. It would thus be seen how utterly impossible it was to give an exact statement when the books were kept in the manner demanded by the Local Government Board. They proposed to have a separate set of books, and to base all future calculations on the working from March to March. On coke, there was a decrease of £282; on tar and liquor, an advance of £160. Last year nothing was realized from spent oxide; this year, £90 was received. The value of the residuals had declined 5 per cent., owing to the difference in the price of coke. The expenditure and maintenance account was equal to 4·28d. per 1000 cubic feet. Only £97 more had gone in wages, although the quantity of gas made was greater by 11 million cubic feet. The extra bulk only cost 2·26d. per 1000 cubic feet, as compared with 4·28d. for the whole. The more gas they made, therefore, the cheaper it was produced, and the greater profit was obtained. During the past year, 8146 tons of coal were carbonized—an increase of 842 tons. The interest paid represented upon the cost of gas sold 2·38d. per 1000 cubic feet made. The sinking fund had been reduced again, according to the number of feet sold, to 3·82d. per 1000 cubic feet sold. Bingley was paying off its sinking fund at the rate of 4·44d. per 1000 cubic feet a year. Seven neighbouring towns were, on an average, paying theirs off at the rate of 1·36d. per 1000 cubic feet. This was a highly satisfactory state of things. The gross profits for the year were £3426—equal to 16 per cent., or 12 per cent. after deducting interest. This was the amount of profit which would have been made by a company with no sinking fund to pay off. The profit had been derived chiefly from the sources he had already mentioned, and from the better quality of the coal used. Only in one previous year had the coal been equal to that consumed last year. The increased consumption was both for ordinary lighting and for cooking. In the latter department, the advance was 3 million cubic feet. The capital invested was £2967; and the net revenue was £1419, or equivalent to 47 per cent. of the capital expended. The gas sold per mile of main in 1875 was 2,811,800 cubic feet; and then there were 10 or 11 miles of mains. Now the mileage was 24; and the consumption per mile, exclusive of the cookers, was 2,565,033 cubic feet. The consumption of the cookers had, however, brought about an advance to 3,000,017 cubic feet per mile of main. Dealing with the efficiency of the works, he said they had 100 retorts, of which, during the whole of last winter, 90 were going. The Council would soon have to seriously consider what would have to be done regarding an extension of the works to the amount of probably £10,000, but not to be spent at once. This outlay would not increase the price of gas or the rates. When it was time for financial proposals to be brought forward, he was sure every member of the Committee and the Council would do what he could to formulate a scheme which would obviate both of the consequences he had indicated. The alternative was the electric light. On the face of it, they did not want this light at Bingley. It was proposed to reduce the price of gas 2d. per 1000 cubic feet for everything but gas-engines. The Committee were unanimous for the reduction. All opposition was withdrawn, because it did not affect any vital point. The cause of their success was twofold—first, the conspicuous ability of Mr. Malam; and, secondly, the spirit of forbearance, generosity, and magnanimity which for so many years had permeated their Committee meetings. If this spirit continued, he neither cared whether they increased the gas-works or used electricity, for the same successful working would continue, and the town would still receive benefits from such able management and generous co-operation. Mr. Harrison seconded the motion; and it was carried.

In the course of the Chairman's remarks, he referred to the position of the undertaking in the year 1875 and now. We have received a tabular statement showing the results of the working in this period, during which the management has been in the hands of Mr. Malam; and we shall take an early opportunity of noticing the principal figures in the document.

TIPTON GAS SUPPLY.

The accounts of the Gas Department of the Tipton District Council for the year ending March 31 last, as certified by the Auditor (Mr. H. T. Mobberley) have lately been issued. The amount originally borrowed (in 1880) to allow of the purchase of the undertaking from the Birmingham Corporation and the erection of works was £30,000. Two years later, a like amount was raised; and subsequent loans have brought up the total to £82,100. Of this, however, £10,399 had been paid off at the close of the past financial year; leaving a balance of £71,701. The amount of interest paid up to that date was £42,874. The capital account shows receipts to the extent of £84,428; the difference between this and the total amount of the loans being a sum of £2328 expended out of profits. With the exception of £2957, the whole of this money has been spent; but only £142 in the past twelve months. The revenue account shows that the sale of gas produced £9758; residuals, £2414; and the total receipts were £12,400 as compared with £13,216 in the preceding year. The expenditure on gas manufacture was £6100; on distribution, £581; on public lighting, £1158; and on miscellaneous expenses, £8095—leaving a balance of gross profit of £4305, as against £4513. Out of this, £3010 was required to meet the interest on mortgages; £1251 was taken to the sinking fund; and £32 to the accumulated profits account, bringing it up to £407. A sum of £100 of this was written off the cost of the extension of the regenerative furnaces; leaving £307. Appended to the accounts is the following comparative manufacturing statement by the Engineer and Manager (Mr. Vincent Hughes):—

	Year 1895-6.		Year 1894-5.
Coal and cannel carbonized (per ton of 20 cwt.)	7638 tons.	..	8157 tons.
Gas made	81,789,000 cub. ft.	..	86,220,000 cub. ft.
Make of gas (per ton)	10,708 ,,	..	10,570 ,,
Gas sent out of works	81,675,261 ,,	..	86,109,403 ,,
Gas sold and used on works	75,077,797 ,,	..	77,706,987 ,,
Leakage, condensation, &c.	6,597,464 ,, (or 8·78 per cent.)	..	8,402,416 ,, (or 9·75 per cent.)
Average illuminating power	17·35 candles.	..	17·47 candles.

NEATH CORPORATION GAS SUPPLY.

A Satisfactory Balance-Sheet.

The annual report of the Engineer and Manager of the Neath Corporation Gas-Works (Mr. Robert A. Browning) is a record of favourable progress. Although the past winter was so exceptionally mild, especially in comparison with the corresponding period of the previous year, there was an increased profit of £82. The statement of loan capital shows that out of the £58,500 borrowed, £35,107 has been repaid; leaving a balance of £23,393 now due. The statement of capital shows that £1198 has been expended; leaving a debit balance of £886. This cause, coupled with no working capital, accounts (says Mr. Browning) for the chronic overdraft at the bank, and should receive the attention of the Committee. The gross profit of the year

amounts to £2879; being an increase of £82 upon the preceding year. Coal cost less by about £100; owing to the reduction in price, though this benefit only obtained in nine months, and 76 tons more were carbonized. The other items generally exhibited a reduction; so that the total saving in the expenditure amounts to £181. On the other side of the account, an increased consumption of gas is shown, notwithstanding the cause before mentioned; the money loss by the sale of gas being only £47 upon the previous year. The reduction in the price from 3s. 4d. to 3s. 2d. per 1000 cubic feet represents about £240; so if it were not for this, the sale of gas would have shown an increase of about £200. There was a loss of £94 on residual products—mainly due to the wretched state of the sulphate of ammonia market. But tar and the profit on fittings presented a substantial increase; so that altogether the receipts only decreased by about £99. The quantity of gas made per ton of coal carbonized was 10,011 cubic feet; and the average illuminating power for the twelve months was 16·5 candles, and this without the aid of cannel. The balance of profit and loss has been appropriated as follows: After paying £1115 interest on the different loans, £200 has been placed to the depreciation fund account (which now shows a credit balance of £190), and £800 has been placed to the repayment account (£200 more than formerly); leaving a balance of £3135 to be carried forward. When the above report came before the Town Council at the last meeting, Mr. E. Davies paid a high compliment to Mr. Browning upon his continued successful working of the undertaking. The report was adopted.

SALES OF SHARES.

At the Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards conducted a successful sale of shares and stock of various gas and water companies. The sale opened with the offer of £2412 of ordinary 5 per cent. stock of the Crystal Palace District Gas Company, the last dividend paid on which was at the rate of 5¼ per cent. per annum. It was put up in 24 lots, 8 of which were knocked down at £137 per cent., and the remainder at £138 per cent. A small parcel of "D" stock of the Wandsworth and Putney Gas Company was sold at the rate of £307 10s. per cent. "A" stock of the Barnet District Gas and Water Company fetched at the rate of £252 10s. per cent.; "B" stock, at the rate of £205 per cent.; "C" stock, at the rates of £242 10s. and £245 per cent.; and "D" (water) stock, at the rate of £180 per cent. Some £20 shares in the Hastings and St. Leonards Gas Company fetched £50 10s., £51, and £52 each. Two £53 "A" shares in the Portsea Island Gas Company were sold for £171 apiece; one £50 "B" share, for £170; and four £50 "C" shares, for £155 each. A number of £10 shares in the Chipping Norton Gas Company, Limited, were purchased for £14 each; a few in the parcel fetching £14 2s. 6d., £14 7s. 6d., £14 10s., and £14 15s. apiece. Ordinary £10 shares in the Enfield Gas Company sold for £17 2s. 6d. each. A small parcel of £10 shares in the Soham and District Gas Company, Limited, found a purchaser at £3 15s. per share. Some original £10 fully-paid shares in the Bournemouth Gas and Water Company (the last dividend having been at the rate of 13 per cent. per annum) were sold for £33 15s. and £34 10s. each; some "B" shares, of the same nominal value, carrying 7 per cent. dividend, realizing £19 5s. and £19 12s. 6d. each. Original shares (£5) in the Bognor Gas Company changed hands at £13 5s. each. Some £25 original shares in the Winchester Water and Gas Company were knocked down at £62 per share. Fully-paid £10 shares in the Ascot District Gas Company, the last dividend on which was at the rate of 2½ per cent. per annum, were sold for £7 2s. 6d. each. Some £10 shares in the Worthing Gas Company were disposed of for £17 apiece. Original £10 shares in the West Kent Gas Company fetched £20 each; two new shares of like nominal value, but with £4 paid upon them, being sold for £8 5s. each.

The following shares were sold last Tuesday: Nine £10 shares in the Ashford Gas Company, at £21 and £21 5s. each; one fully-paid £5 share, at £10; ten £5 shares (£3 paid), at £7 10s. each; and two, at £7 15s. each. Four £5 shares in the Lydd Gas Company were knocked down at £5 5s. each. Some £10 shares in the Bishops Stortford Gas Company changed hands at an average price of £20 each. On the following day, Messrs. Nicholls and Tresidder sold at Falmouth 114 shares of £1 each in the Falmouth Gas Company, Limited; 80 realizing £2 8s. each, and the remaining 34 being knocked down at £2 9s. 3d. each. On the same day, Mr. T. Wickens Fry sold at Deal some £10 "B" shares in the Deal Water Company at £17 each; some £10 "A" shares in the Deal and Walmer Gas Company, at £22 apiece; some "B" shares (25s. paid), at 28s. each; some £10 "C" shares (£7 10s. paid) at £14 each; and two £50 4 per cent. debentures, at £51 each. At a sale by auction at Wakefield last Friday, some £5 "A" shares in the Ossett Gas Company were sold for £14 and £14 2s. 6d. each; and £5 "B" shares, for £10 5s.

Bursting of a Water-Main in the Camden Road.—Shortly after eight o'clock last Tuesday evening, one of the New River Company's mains burst with great violence, just above the point at which Hillmarten Road crosses the Camden Road, and close to Holloway Prison. From this spot the Camden Road slopes to the Holloway Road; and down this incline the water rushed with great force—increasing in volume until it had attained a depth of several feet. At the junction with Holloway Road the stream divided, and, aided by a downward incline in either direction, it penetrated to the extent of a full furlong each way—that is to say, nearly to Holloway Station on the south, and considerably past the Nag's Head on the north. Fortunately the matter did not remain long beyond the cognizance of the representatives of the Company; and steps were promptly taken to stop the flow. It happened that at the time of the accident certain of the Company's men were on duty in Parkhurst Road, which branches from the Camden Road, just at the point where the mishap occurred; and within a quarter of an hour from the time when the main burst, measures were being taken for meeting the exigencies of the case. The water was promptly turned off; and though the outflow did not immediately cease, it gradually subsided until it stopped altogether.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, 60, Gracechurch Street, E.C.—Mr. J. Birch Paddon in the chair.

The Secretary (Mr. A. W. Cooper) read the notice calling the meeting, and the Directors' report and the accounts were taken as read. The latter showed an income amounting to £35,952; and a balance, after meeting the general outlay, of £9539.

The Chairman, in moving the adoption of the report and accounts, said he should briefly refer to some of the incidents of the year so far as they related to their respective stations. There had been no improvement in the general trade of the Island of Malta. That trade, as the proprietors would no doubt well remember, was largely dependent upon the number of steamers calling there, and also upon the use of the harbour by the Mediterranean fleet. The number of steamers calling was fewer last year than usual; and the Mediterranean fleet had been most of the time in the Levant. Notwithstanding these unfavourable conditions, they had managed to sell about 3 per cent. more gas; had taken on abou 84 new consumers; and had added 50 per cent. to the number of stoves they had out previously. Thus he thought they might consider their business in Malta had been so far satisfactory; and very much of this was attributable to the wise energy of their Manager (Mr. Starkey). The scheme of the Government for supplying electric light had not yet been completed; and up to the present the Company were unaffected by it. The Directors were, however, led to believe that it would be brought into operation gradually; and, if so, it would be the better for the Company. Commercially speaking, it was not possible there could be any competition between the Government and the Company; he meant this for reasons apart from the great disparity of price between the two lights—the price of electric lighting being so enormously in excess of that charged for gas. The considerations of cost and economy had not much weight with the Chief Secretary at Malta; but they were things that could not be ignored altogether. Meanwhile, the efforts of the Directors must be directed to recouping the loss of business which would shortly have to be sustained. What that loss would be nobody could tell at the present time. But no doubt a considerable slice of business would go from them; and they must endeavour to recoup it as quickly as possible. The Directors believed they could do this, and without increasing the present selling price of gas. In August last, a very full statement of the Company's affairs at Corfu was laid before the proprietors, who then authorized the sale of the Company's undertaking in Corfu to the Société Georgi, of Paris, for the sum of £20,000. This sale had been completed; the proceeds invested; and the works were handed over to the Société Georgi on Feb. 1 last. The Company had, however, a considerable sum of money owing to them from Corfu. The Municipality were indebted to them to the extent of about £3700; and they had probably rather more than £300 still uncollected from private consumers In regard to the whole of this money, there did not appear to be any contention or dispute; and it would no doubt all be paid in course of time. The Municipality were endeavouring to raise a loan for this and other purposes; and upon getting powers for the loan, the Company would be paid. As to the smaller sums owing by the private consumers, they would probably take the longest time the law would allow before paying their accounts. The whole of the money owing was under proper legal process, and carried interest with it; so that the Company did not stand to lose much by it. In Trapani and Marsala, they had been doing fairly well. There had been no revival of trade, which was as bad as ever; but rather more gas had been sold. It was satisfactory to know that in the municipal governments of those places, there had of late been more power and energy, and a desire to have things more in order, than had hitherto been shown. It would be the duty of the Directors to assist them (and that they would do most willingly) in all efforts for improvement which they might make from time to time. The island had not got over the effects of the late political disturbances; but they were gradually disappearing. When they had been quite wiped out, he thought there was no doubt trade would revive, and would get back to its normal condition; and, if so, the Company would sell more gas. The whole of the works were in their usual excellent working order. Referring next to the profit and loss account, the Chairman said the whole of the items on the debtor side down to "exchange" were very similar to those of last year; but, taking them together, they were £1036 less. With this there could be no fault-finding; but he might point out this was to some extent the result of their having only ten months' working at Corfu in these accounts. The expenditure was less, and the receipts were less, but not so much as the expenditure. In reference to the swollen charge of exchange, he might point out that the whole of the Company's liabilities in that respect upon the money owing to them at Corfu had been brought into this year's account. It might have been placed to the account of next year; but it would really have made no difference, and the course they had taken had received the approval of the Auditors. If they had not done it this way, they would have taken it from the reserve fund, and charged it next year in the account. Therefore, next year the item of exchange would be very different to what it was in the present accounts. Then, as to the working of the year. The quantity of coal used had been 13,144 tons. They had made 136 million cubic feet of gas, and had sold 116½ millions; and the difference between the two worked out to 14·4 per cent. This was the largest percentage of unaccounted-for gas they had had for many years; and careful inquiry had been made concerning it. It turned out that it had occurred chiefly at Malta; and it was better that it should be so, because their means of dealing with it there were much better than at any other of the stations. The management at Malta wished to emphasize the effect of temperature in regard to this matter, and to say the gas had not been lost, because it was never produced. But making all allowances for excuses in this way, the loss had been greater than could be tolerated; and the Directors had already inaugurated the necessary steps for the discovery and remedy of the leakage. He trusted they would be successful in this respect. Their rental was £260 less; but the ten months' working at Corfu was enough not only to account for this, but also for the increase at the other stations. Through much the same cause, there

was a loss of £79 upon coke; but they had gained £30 upon fittings and meters. The outcome of the accounts was that, after the payment of the dividends recommended, they had a sum of £940 to carry forward. If they had not made the large charge to exchange, they would have had to carry to reserve a similar sum to that which they carried last year. He had no doubt the question had suggested itself to the minds of the proprietors as to what the Directors were going to do with the proceeds of the sale of the Corfu property. Well, a very proper use of the money would be to pay off debentures to that extent. They had already given notice for payment of £4000 of debentures after the first of next month. If they could not find any better use for the money, they would go on, and, as the debentures fell due, they would be paid off. The Board, however, would keep a watchful look-out; and if some equally secure and more profitable mode of dealing with the money came to their knowledge, the proprietors would be called together to consider it.

Colonel J. Le Geyt Daniell seconded the motion.

Mr. H. Smith said he believed some debentures would become due on Jan. 1 next; and he asked if they would be paid off if nothing else turned up in the meantime. He also inquired if the incandescent gas-light was used in Malta. He was glad to see that there was another Incandescent Gas-Light Company—the Sunlight—which had produced a stronger mantle than the Welsbach. He had tried the latter, and had come to grief over it.

The Chairman replied in the affirmative to the question regarding the debentures. As to incandescent gas-lights, they were largely employed in Malta; and their use was increasing. This was, of course, a matter for the consumers; and all the Company could do was to facilitate their adoption, which they did as far as they possibly could.

The Secretary, answering further inquiries, stated that £2050 of the £4837 charged under the heading of exchange was on account of Corfu. The interest on the £3500 debentures now falling due was 5 per cent.; and the remainder received 4½ per cent.

On the motion of the Chairman, seconded by Mr. Stephenson R. Clarke, the usual dividends on the first and second preference capital, and a dividend of 4 per cent. on the ordinary capital (making, with the interim dividend, 6 per cent. for the year), were declared.

The Chairman moved the re-election of the retiring Director (Colonel J. Le Geyt Daniell); remarking that the proprietors were under great obligation to the Colonel for what might be called special services rendered to the Company outside the ordinary routine duties of a Director.

Mr. G. J. Newbery seconded the motion, which was unanimously carried.

Mr. J. Cash moved, Mr. J. Westbrook seconded, and it was agreed, that the Auditors (Messrs. R. Hesketh Jones and T. Guyatt) be re-appointed.

The usual complimentary votes to the Chairman and Directors and officers and staff terminated the proceedings.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Thursday, at the Offices, Commercial Road, Pimlico—Sir W. H. Wyatt presiding.

The Secretary (Mr. G. H. Gill) having read the notice calling the meeting,

The Governor moved the adoption of the report. He stated that there was very little for him to add to the information contained therein; for it really set forth everything the Directors could think of that it might interest the proprietors to know. The income for the half year had been £76,230, or an increase of £1290; and the working expenses, though heavy (£24,517), did not exceed the proportion to income to which they had expected them to go. The expenditure on capital account had amounted to £3364, of which £2400 was for extensions of service mains, chiefly in the Fulham district; and the remainder was for fixing hydrants recently brought under the constant supply. The last-mentioned sum was repayable to them by the London County Council. The Directors and officers had had a good deal of anxiety, as he supposed they always would have, though he hoped that the worst was over now, because he thought that the County Council were for the moment prevented from continuing their attack on the Water Companies. The objection to the attacks of this body was that they cost so much money, and took up so much of the time of the staff. The Company had got their Private Bill passed through the Commons; and it had also had its second reading in the House of Lords unopposed. He therefore assumed that they would not have very much more trouble in connection with it. As stated in the Directors' report, the object of the Bill was to enable the Company to raise additional capital, for the purpose of constructing a new filter-bed and laying a new 36-inch main between their Molesey and Surbiton works. If the Directors could have more peace, they would be able to give their time more to developing the affairs of the Company, than they had recently been able to do; but he could assure them that they had done their best. A good deal of building had been going on in the Fulham district, and there had consequently been a large outlay by the Company; but this they must not regret, as they ought to be able to get the money back. The Engineers reported that the whole of the works, buildings, and machinery were in first-rate order; and, so far as the Directors could personally judge from an inspection, this statement was quite correct. As he had said, they hoped that they had now got through Parliament with their Bill; but they never knew. The moment it was finally passed, they would be able to go on with the works authorized, which would be a convenience in enabling them to get more water at Surbiton, though he did not think it would be any great pecuniary advantage to them.

The Deputy-Governor (Mr. F. S. Clayton) seconded the motion, which was carried unanimously.

The Governor afterwards proposed the payment of a dividend of £5 2s. 6d. per cent. on the ordinary capital stock, less income-tax; being the usual dividend of 5 per cent. for the half year, and 2s. 6d. per cent. extra on account of previous dividends which had fallen short of the statutory yearly rate of 10 per cent.—the dividend to be paid on the 5th prox. "to the several persons and corporations who are on this day proprietors of such capital stock, excepting only such of the holders of 4½ per cent. preference convertible stock as have converted their holdings into ordinary stock, and whose right to participate in ordinary stock dividends takes effect from March 31, 1896." He observed that the only remark which he need make in proposing the resolution was that it was very gratifying to the Directors to be able to continue paying the extra 2s. 6d. per cent.; and he sincerely trusted that they might go on doing so. It was easy to increase their expenses, and most difficult to keep them down; but he believed that as long as they had their present Directors, the latter would endeavour to keep the expenses as low as they fairly and legitimately could.

The Deputy-Governor seconded the motion, which was carried.

Mr. Besley said he understood that the names of the retiring Directors had to be submitted separately for re-election. He would like to propose the re-appointment of Sir W. H. Wyatt; but his remarks applied to all the members of the Board. The management of the Company had been very successful indeed, especially in Parliament in the recent inquiry, when he thought that they prevented the sealing of the intake at Thames Ditton, so that in case of emergency and accident they might, with notice, use this intake. He understood that the evidence of experts proved satisfactorily that the quality of the water there was perfectly good for the use of the population.

Mr. Ward, in seconding the motion, remarked that Sir William Wyatt had been Chairman of a sister Company for many years; but he had felt it necessary to resign that position—the Company in question, however, having the good fortune still to retain his services as a Director. It must be a source of great satisfaction to the shareholders of the Chelsea Company that, when he elected to seek some relaxation from his work, Sir William decided on resigning the chairmanship of the other Company, preferring to continue to occupy the position of Governor of their own undertaking.

The motion was unanimously carried; and Mr. Clayton and Colonel Sir Wilford Brett, the other retiring Directors, were also re-elected.

After the re-election of the retiring Auditor (Mr. James A. Hallett), a resolution was passed raising the remuneration of the Auditors to 100 guineas per annum, to be divided according to attendance each half year.

Mr. Ward afterwards proposed a cordial vote of thanks to the Governor and Directors for their services in the past half year. He only trusted that the Governor had not spoken too hopefully in expressing the view that there was some prospect of a falling off in the constant attacks made upon them by the London County Council. He hoped that Sir William Wyatt might long be spared to occupy the very responsible position which he held on their Board.

Mr. Besley seconded the motion, which was carried unanimously.

The Governor, in reply, said that, while he was delighted at the fact that there seemed, at all events, to be a prospect of a little more peace for them, the proprietors might rely upon the Directors doing in any case the very best they could to protect the interests of the Company.

The proceedings then terminated.

A DEFENCE OF GAS.

As a general rule, managers of gas-works are too much occupied in meeting the demands of the consumers to take much notice of what appears from time to time in the cheap papers in depreciation of their illuminant or in laudation of its so-called rival. Chatty articles of a *quasi*-scientific character, describing how electricity is generated and how it is utilized in the production of light, amuse, and possibly instruct, a certain class of readers; and they may be left to have what effect they may. But when writers begin to make comparisons between the cost of the electric light and gas, the gas manager has to be on the alert to see that he and his illuminant are not prejudiced. It was probably with something of this feeling that Mr. T. Canning, Assoc.M.Inst.C.E., the Engineer and Manager of the Newport Gas-Works, ventured to question the statements put forward by a writer in the "South Wales Argus" a few days ago. Dealing with the question of cost, the latter gentleman quoted Mr. Preece to the effect that, on an average, "electric light at 6d. per unit is equal to gas at 3s. per 1000 cubic feet;" while Professor Kennedy was given as the authority for the statement that an 8-candle power lamp costs about one-eighth of a penny per hour when the charge is 6d. per unit. Then Dr. Fleming was cited as saying that "a customer paying 6d. per electric unit would pay just as much for a 16-candle power electric incandescent lamp per hour as he is now paying for a 16-candle power gas-jet per hour, and get all the advantages in health and comfort thrown in." Finally, the experiments of Mr. A. P. Trotter at Hastings were referred to; and his figures of 4d. and 6d. per unit as the equivalents of gas at 2s. 6d. and 3s. 4d. per 1000 cubic feet were adduced. Mr. Canning attacks first the statement of Mr. Preece, which was shown to be incorrect at the time it was made, seeing that his calculations were based upon results yielded by an old fishtail burner, giving about 2 candles per cubic foot. The writer of the article, when dealing with the unit of electricity, put it as being equal to 320 candles. Mr. Canning neither disputes nor admits this, but takes it as it stands; and this is what he shows can be obtained for 3s.—

	Candle-Hours.
6 units of electricity, at 6d. per unit	1920
1000 cubic feet of gas, at 3s., reckoning only 3 candles per cubic foot	3000
1000 cubic feet of gas, as supplied at Newport, taking the mean of 1895, 3·38 candles per cubic foot . . .	3380

So that, at the lower computation, gas in any good ordinary burner is 56 per cent. cheaper than electricity; and when consumed in the best argand, 76 per cent. cheaper. Knowing that suspicion will probably be cast upon his figures, he backs them up by a statement contained in the "Electrical Engineer" for Jan. 31 last. That publica-

tion gave a comparison of the price of gas and electricity in a very able paper, describing one of the most perfect and most modern installations of electric light in Europe—that in Cologne. Mr. Canning has translated the denominations from German into English, and simply gives the results. The price of gas in Cologne is 4s. 6d. per 1000 cubic feet. The price charged for electric current is 8·4d. per unit; and the comparison made by electricians between the cost of gas and electricity is that gas costs exactly two-thirds of the electric light. Therefore that light at 8·4d. per unit is equivalent to gas at 6s. 9d. per 1000 cubic feet in that city. As the unit is the same all the world over, he reduces it to the price of 6d. per unit, and shows that electricity at that price is equivalent to gas at 4s. 9½d. per 1000 cubic feet. This is with ordinary burners. What about incandescent lighting? On this subject the writer of the articles was prudently silent. Not so Mr. Canning. He says: "The incandescent gaslight, with a consumption of 3·5 cubic feet per hour, gives an average illuminating power of 45 candles; being at the rate of 12·88 candles per cubic foot. Therefore, 1000 cubic feet of gas consumed on this principle give 12,880 candle-hours for 3s. We have seen that it costs 3s. to supply 1920 candle-hours by electricity; so that lighting by electricity costs 6·7 times more than incandescent gas lighting. In other words, lighting on the latter system entails only one-seventh the expense of lighting by electric lamps."

The writer of the articles laid himself open to attack from another point. He would be a poor newspaper man who could not decry gas on the ground of its vitiating the atmosphere. "A couple of gas-jets in a room," he says airily, "will vitiate the air (at least some of the scientists tell us so) as much as the breathing of 20 men; while the electric light has no effect." Mr. Canning asked for the name of one scientist who had made such a statement; and he was referred to the compiler of a manual on 'Hygiene." Mr. Canning gives an analysis by Dr. Frankland of ordinary coal gas, and says: "In combustion, 1 cubic foot of coal gas gives off 0·6156 of a cubic foot of carbonic acid. A man in breathing—an adult weighing 12 stone, and in a state of repose—gives off 0·72 cubic foot of carbonic acid per hour. Therefore, two gas-jets of 5 cubic feet each give off in an hour 6·156 cubic feet of carbonic acid—exactly the quantity which would be given off by 8·55 men. Now, why is it found necessary to exaggerate this, like Falstaff's men in buckram, into 20? One reason is that carbon dioxide, as I shall prove presently, has no injurious effects unless present in very large quantities. I may point out that one of the commonest errors which I have noticed has been the assumption that all the oxygen used in gas combustion combines with carbon to form carbonic acid; and I know one compiler of a manual who gives a larger volume of carbonic acid produced than of oxygen abstracted from the air for the combustion of both hydrogen and carbon together. Roscoe and Schorlemmer, in Vol. 1. of their 'Treatise on Chemistry,' point out that carbonic acid is not, as ignorantly supposed, a poison. In fact, this is obvious on reflection, as it enters the lungs frequently in respiration, and is certainly leaving the lungs continuously; so that it is always present in the system. Berzelius, the greatest chemist who ever made experiments on this matter, has proved that air diluted with 5 per cent. of carbon dioxide may be safely breathed." Mr. Canning concludes by pointing out that electric lighting is not the perfect remedy for vitiated air that is claimed for it. It certainly does not vitiate the air itself; but it cannot remove the effects produced by the lungs. For this purpose, he says, artificial ventilation will still have to be employed; and we may add that any system in which gas lighting is combined will conduce to the advantage of the industry which Mr. Canning is doing his best to protect.

ELECTRIC LIGHTING NOTES.

The general position of the Portsmouth electric lighting undertaking at the close of the first municipal year's working—taking the figures presented by Alderman Ellis to his colleagues at their last meeting—must be described as satisfactory. Twelve months ago, he said, the number of lights in the borough outside the arc lighting of the streets was 4000. They had had very great struggles and difficulties during the first part of the year, owing to the fact that the light had been found by consumers to be much more expensive than they had anticipated. It was not dear as compared with other towns; but merely as compared with the cost of Portsmouth gas. Under the circumstances, the Committee had to either reduce the price of the current or introduce higher efficiency lamps. The result was that, in the first six months of the year, the income fell off, and everything seemed to be going back. They had faith in their policy, however, and that this faith was justified was shown by the fact that whereas on March 30, 1895, the lamps numbered 4000, on March 30 this year they numbered 11,000; and there was an average earning of 11s. per lamp. Now they had 13,500 lamps wired, and had orders for upwards of 500 more; making practically 14,000 lamps. This was evident proof that the light was reliable and cheap, and that the public had faith in it. Reckoning 9000 lights as the average for the year, they earned 11s. per light. As twenty gas-burners would cost over £10, the electric light was actually as cheap as gas. With one exception—Leeds—the current was manufactured in Portsmouth at a lower cost than in any other town in England. In Portsmouth, the cost was 2·06d., and in Leeds, 2·05d., or 1-100th of a penny lower. The price of coal was lower in Leeds. In Portsmouth the very lowest price was paid for their current—3·90d.; they obtained only 3d. per unit for arc lighting, and 4d. from private consumers. If they were a private company, they would have made 4·41 per cent. on the year, or just upon 4½ per cent.; so that he thought they might be justly proud of their year's working. They had made £3300 net profit. This did not quite cover the sinking-fund payment; and they were £420 short on that, owing to the fact that machinery ordered for extensions was all behind, and they received no revenue from the first winter quarter in the season. The foregoing statement was made by Alderman Ellis in introducing for adoption a report which recommended that an engine of 1000-horse power should be ordered at a cost of £6200, and that application be made to the Local Government Board for sanction to the borrowing of £10,000. These proposals were agreed to.

The ratepayers of York are greatly aggrieved by the large increase in the rates. Very naturally, therefore, they have raised their voices against the Corporation venturing into the electric lighting business, and thus adding to the rapidly growing public debt of the city, and, in all likelihood, dipping deeper into the pockets of the ratepayers. In 1886, the rates amounted to 3s. 5d. in the pound; while now they stand at 6s. 8d. In 1891, the city debt was £224,428; by last year it had risen to £465,682; while now it is believed to be about half a million. It is clear from these figures that the ratepayers are perfectly justified in the action they are taking in regard to the electric lighting question. They held a meeting a few days since, which was well attended, and at which information was laid before them as to the experiences of other places in electric lighting. It was stated by Mr. H. Scott, who presided, that Bristol, with 228,000 people, was said to have made a profit of £2500 on electric lighting. This looked very well; but, when they had to pay £3600 on the sinking fund, it meant that they had to draw £1100 a year out of the ratepayers' pockets. From Sunderland he had learnt that the Queen's Hotel had recently given up the electric light, and had adopted incandescent and other gas-burners on account of the reduced cost, and other buildings had followed suit; while the Corporation last year lost £1000 on the undertaking, which amount had, of course, to come out of the rates. York gas was now very cheap; and he believed the Company would still further reduce the price. A resolution was then moved protesting against the adoption by the Corporation of an electric lighting system, or the financing of any company with the ratepayers' money. From remarks by subsequent speakers, it is evident that the ratepayers have not much faith in the ability of the Corporation to manage such an undertaking. The resolution was carried unanimously; and a further one was passed, urging the Lord Mayor and Council to give effect to the wishes of the meeting.

At a recent meeting, the Canterbury Town Council adopted certain recommendations of the Lighting Committee with respect to electric lighting. In the first place, Mr. R. Hammond is to be the Engineer to carry out the works; and he is to have a commission of 5 per cent. on the total cost (but exclusive of the purchase-money of the dust-destructor, on which no commission is to be paid), in which the fee of 50 guineas already paid is to merge. Mr. Hammond is to be solely responsible for the whole of the buildings, but to be permitted to obtain the assistance of the City Surveyor at his own expense, and to be allowed to charge ordinary fees on any work that the dust-destructor may entail on him. The Committee recommended that the Millers' Field should be utilized for the station; this site being the largest and most central of any available. The Mayor (Mr. S. H. Dean), in proposing the adoption of the minutes, said he hoped the members of the Council would not enter into the project with too light a heart, as there was no doubt that for the first two, three, or four years the electric light would involve a rate of probably 3d. in the pound. Their object must therefore be to carry out the scheme in the most economical manner possible. Alderman Mason seconded the motion. After some discussion, Alderman Hart referred with approval to the words of warning used by the Mayor in introducing the subject, and said that, in his opinion, an expenditure of £20,000 and the prospect of a resulting 3d. rate for some years to come, ought to be seriously considered. He was opposed to laying out such sums without benefit to the whole of the community. These words of warning were cut short by Alderman Mason, who contended that Alderman Hart was out of order in discussing a step which had already been decided upon. Alderman Hart said he protested against the Council going to the Local Government Board to borrow the money. The Town Clerk ruled that the matter had been settled at a previous meeting. The question for discussion was, he said, as to the appointment of Mr. Hammond and the selection of a site. Alderman Hart said that, in protesting, he was only doing his duty to those who considered the electric light was a luxury rather than a necessity. As already stated, the minutes were adopted, subject to an amendment referring back to the Committee the question of paying travelling and out-of-pocket expenses to Mr. Hammond.

The Public Lighting of Paignton.—A discussion arose at the meeting of the Paignton District Council yesterday week respecting the contract with the Gas Company for lighting the street-lamps. The Company offered to renew the contract for a year at a price of £1 18s. per lamp, as against £1 13s. 6d. hitherto paid, or £1 14s. for incandescent lights. The Lighting Committee reported that they had tested 25 lamps which had meters, and estimated that at the price charged to ordinary consumers the cost of the gas consumed would be only £1 10s. per year each lamp. Mr. Palk, the Chairman of the Gas Company, said the Council were mistaken as to the quantity consumed. The Company would be very willing to supply all the lamps by meter if the Council would provide the meters, and keep them in order. The Chairman (Mr. G. S. Bridgman) pointed out that the streets would be in darkness unless the contract was renewed; and it was decided to accept the Company's terms.

Gas v. Electric Lighting at Wimbledon.—"Keep pegging away," is a bit of advice which comes to the slow Britisher from his American cousin; and the advantage of following it is not unfrequently strikingly illustrated even in the Old Country. An example is furnished by a place no farther off than Wimbledon. There the Local Authority, as our readers are aware, wanted to introduce a scheme of electric lighting; and a large section of the ratepayers would have none of it. One of the body took up the question very warmly; and by circulars and in other ways he succeeded in checking the proposed extravagant expenditure. Seeing the position of affairs, the Gas Company came forward with an offer to put up some incandescent gas-burners to show what could be done; but it was declined. Since the last election, however, things have worn a different aspect, and now the Company have been invited to renew their offer, and moreover to quote a price for gas. This must be specially gratifying to "Ratepayer" and his numerous friends who have steadily opposed the electric lighting scheme.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week, as all your readers will know, there have been numerous gatherings in Glasgow to celebrate the fiftieth year of Lord Kelvin's occupancy of the Chair of Natural Philosophy in the University of Glasgow. It would be out of place here to narrate the incidents of the week, or the work of one of the greatest physicists of all time. His leading inventions and appliances are all well known, and have been of immense benefit to mankind. In fields electrical he has done great service. Probably the gas industry possesses nothing of importance, either in apparatus or practice, which has emanated from his mind; but the followers of that industry are interested in many of the problems which he has helped to solve, and they unite with others to do him honour. It will be remembered that in 1892 the North British Association of Gas Managers sought, and obtained, his assistance at the unveiling of the memorial to William Murdoch, in the Wallace Monument at Stirling; and the same Association have agreed to name after him the bursary which they propose to found in Glasgow University by means of the Murdoch Memorial Fund.

The Town Council of Dundee had before them on Wednesday the annual accounts of the gas and electricity departments for the year ending April 30, and the estimates for the current year. Under the estimates, it was proposed to reduce the price of gas from 3s. 4d. to 3s. 3d. per 1000 cubic feet, to abolish meter-rents in both departments, and to retain the charge for electric current at 3d. per unit. The quantity of gas was set down at 523 million cubic feet; the coal at 50,288 tons; the cost of coal, at 11s. 2d. per ton, £28,077; the wages of firemen, £7543; and breakage and haulage, £1676—making a total of £37,296. Among the other items which formed the expenditure side of the account were: Interest, £6000; annuities, £7243; assessment, taxes, &c., £5000; salaries, including collection of revenue, £3000; and sinking fund, £7500. The total expenditure was estimated at £79,583. On the other hand, the income was estimated to amount to a total of £80,055. The net revenue from the gas supply was stated at £73,422; chemical products were expected to yield £5000; and, with other small items, the account was raised to £78,928. The electrical accounts had closed with a surplus of £1126; and the gas department benefited to this extent. The total revenue was thus raised to £80,055. The revenue in the electrical account was estimated at £5225, and the expenditure at £4493, leaving a surplus of £731.

Treasurer Ritchie, in submitting the accounts, said: "How, it may be asked, are we in a position to entertain such proposals, involving, as they do, a remission of charges amounting to about £5000, of which meter-rents represent about £3000, and gas the remaining £2000? The explanation is to be found partly in our anticipated consumption of gas, which we expect to produce at a smaller relative cost than hitherto—as our contracts for coals have been happily made at a decrease of £1447 10s. 4d. on last year—partly from the repayment by the electricity department of £1126 15s. 1d., and, most important item of all, partly owing to a diminished expenditure on gas apparatus and tools amounting to no less than £3316 12s. 2d. I should state at this point that I have not exhausted the whole surplus, for I propose to treble the contribution to the contingent fund this year; raising it from £500 to £1500. I do so because I regard it as sound policy to increase this fund to such a sum as will enable it to bear any unforeseen charges of an extraordinary nature, or even minor capital expenditure. If the Council adopt the estimate, the contingent fund will be raised to £4500; a sum, possibly, within a thousand or two of the amount actually required for the purposes I have named. As soon as the fund reaches the amount which the Engineer would recommend as adequate, I would suggest that further payment to the fund cease, and be made direct to the sinking fund. No one here will question the propriety of reducing the price of gas by 1d.; but the opinion may be held—and is, I know, held strongly by my friend ex-Provost Brownlee and others—that meter-rents should be allowed to continue as at present, and that the price of gas should be reduced by an additional 2d. Between these proposals, the Council must this day choose. After giving the best consideration to the matter, I have come to hold, even more strongly than I did a few weeks ago, the view—alike on the grounds of equity, simplicity of rating, and acceptability to the community—that meter-rents should be abolished. The rental of the smallest meter is charged at the rate of 7·6 per cent. on cost; that of the next smallest, is 6·4 per cent.; while the charge for the largest of all is only 3.9 per cent. I confess that our charges here are anomalous; they rise and fall on no fixed principle. The rental per cent. for the 100-light meter is 5·8, while that for the 150-light is 4·6. But the special fact, worthy of notice, is that the highest of all the rentals is that for the smallest size of meter." Ex-Provost Brownlee, at one time Convener of the Works Committee of the Gas Commission, moved that meter-rents be retained, and that the price of gas be reduced to 3s. 1d. per 1000 cubic feet. He said that at present the small consumers were getting gas at a price equal to at least 10 per cent. less than the others, as it cost more to give it to them. Those who consumed little or no gas, were getting it at the expense of those who burnt a large amount. To charge meters at maintenance, interest, and sinking fund, and gas at cost price, would, he thought, be to put everyone on an equitable footing; and in no other way could they do it. The motion was adopted by 16 to 5 votes.

The Corporation of Glasgow have on hire 12,646 gas cooking and heating stoves; and other 19,191 have been purchased by the users of them. The suggestion is made that probably a reduction in the rates for hire might be made. This may be; but it is surely evidence that the rates are extremely moderate, that so many hires have been effected. The financial year of the gas department expired on May 31; but the results so far have only been made up to the end of April. There was a total revenue from residual products of £110,313, which was a decrease on the amount received in the corresponding period of the previous

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 1390).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Apl.	10½	Alliance & Dublin 10 p. c.	25—26	..	4 0 9
100,000	10	„	7½	Do. 7 p. c.	17—18	..	4 3 4
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	110—112	..	4 9 3
200,000	10	12 June	5	Belgrano (B. Ayres), Limited	9—10*	+½	5 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	100—105	..	4 15 3
200,000	5	29 May	6½	Bombay, Limited	7½—7¾	..	4 3 10
40,000	5	„	6½	Do. New, £4 paid	5½—6	..	4 6 8
380,000	Stck.	27 Feb.	12	Brentford Consolidated	290—295	+2	4 1 4
210,000	„	„	9	Do. New	220—225	..	4 0 0
50,000	„	„	5	Do. 5 p. c. Pref.	—	..	—
159,375	„	12 June	4	Do. 4 p. c. Deb. Stock.	130—134*	..	2 19 9
220,000	Stck.	27 Mar.	11	Brighton & Hove Original	237—242	..	4 10 11
208,820	„	„	8	Do. A Ord. Stk.	190—195	..	4 2 0
933,500	Stck.	27 Feb.	5	Bristol, 5 p.c. max.	127—132	..	3 15 9
420,000	20	27 Mar.	11¼	British	56—57	..	3 18 11
50,000	10	12 Mar.	11½	Bromley, Ordinary 10 p. c.	22½—23½	..	4 17 11
71,000	10	„	8½	Do. 7 p. c.	19—20	..	4 5 0
500,000	10	29 Apl.	5	Buenos Ayres (New) Limited	9¼—10	+¼	5 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	103—105	..	5 14 3
150,000	20	27 Feb.	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	29 May	8	Cape Town & District, Ltd.	17—18	..	4 8 11
50,000	50	2 May	6	Do. 6 p. c. 1st Mort.	58—60	..	5 0 0
550,000	Stck.	15 Apl.	13½	Commercial Old Stock	342—347	..	3 17 8
165,000	„	„	10½	Do. New do.	258—263	..	2 19 10
165,000	„	12 June	4½	Do. 4½ p. c. Deb. do.	146—150*	..	3 0 0
800,000	Stck	12 June	13	Continental Union, Limited.	285—290*	+2	4 9 8
200,000	„	„	10	Do. 7 p. c. Pref.	217—222*	..	4 10 1
51,600	Stck.	27 Feb.	14	Croydon Com'cial A 10 p. c.	—	..	—
157,500	„	„	11	Do. B 7 p. c.	—	..	—
535,000	Stck.	27 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	135—140	+5	3 15 0
60,000	„	„	5	Do. 5 p. c. Pref.	—	..	—
486,090	10	30 Jan.	11	European, Limited	26½—27½	+½	4 0 0
354,060	10	„	11	Do. £7 10s. paid	17½—18½	..	4 9 3
5,746,590	Stck.	13 Feb.	12¾	Gaslight & Coke, A, Ordinary	310—315	+2	4 0 11
100,000	„	„	4	Do. B, 4 p. c. max.	108—113	..	3 10 9
665,000	„	„	10	Do. C, D, & E, 10 p. c. Pf.	297—302	..	3 6 3
30,000	„	„	5	Do. F, 5 p. c. Prf.	145—150	..	3 6 8
60,000	„	„	7½	Do. G, 7½ p. c. do.	210—215	..	3 9 9
1,300,000	„	„	7	Do. H, 7 p. c. max.	205—210	..	3 6 8
463,000	„	„	10	Do. J, 10 p. c. Prf.	295—300	..	3 6 8
476,000	„	„	6	Do. K, 6 p. c. Prf.	172—177	..	3 7 10
1,061,150	„	12 June	4	Do. 4 p. c. Deb. Stk.	138—143*	..	2 15 11
294,850	„	„	4½	Do. 4½ p. c. do.	148—153*	..	2 18 9
908,000	„	„	6	Do. 6 p. c. do.	203—207*	..	2 18 0
70,000	10	14 May	6	Hongkong & China, Limited	12½—13½	..	4 8 10
3,800,000	Stck.	14 May	12	Imperial Continental	248—252	..	4 15 3
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	13 Feb.	3½	Do. 3½ p. c. Deb. Stk „	109—111	..	3 3 1

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	6½—7	..	4 5 8
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	115—118	..	4 4 10
250,000	100	„	4½	Do. 4½ p. c. Debs.	110—112	..	4 0 4
541,920	20	12 June	5	Monte Video, Limited	16½—17½*	..	5 14 3
150,000	5	29 May	8	Oriental, Limited	8¼—8¾	..	4 11 5
135,000	5	„	8	Do. New, £4 10s. paid	7¼—7¾	..	4 12 10
15,000	5	„	8	Do. do. 1879, £1 paid	1—2	..	4 0 0
60,000	5	12 Mar.	7	Ottoman, Limited	5—5½	..	6 7 3
166,870	10	—	2	Para, Limited	1¼—1⅝	..	—
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	105—110	..	5 9 1
500,000	100	1 June	6	of Chicago } 2nd Do.	102—107	..	5 12 1
250,000	10	27 Mar.	8	San Paulo, Limited	13—14	..	5 14 3
500,000	Stck.	13 Feb.	15½	South Metropolitan, A Stock	405—415	..	3 14 8
1,350,000	„	„	12	Do. B do.	315—320	..	3 15 0
310,000	„	„	13	Do. C do.	337—342	..	3 16 0
800,000	„	16 Jan.	5	Do. 5 p. c. Deb. Stk.	175—178	..	2 16 2
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	250—255	..	4 10 2
60,900	„	„	8½	Do. B	—	..	—
170,380	10	29 May	10	Tuscan, Limited	13½—14½	..	6 18 0
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	100—102	..	4 18 0

WATER COMPANIES.

746,123	Stck.	30 Dec.	10½	Chelsea, Ordinary	347—352	..	2 18 3
150,000	„	„	5	Do. 5 p. c. Pref.	172—177	..	2 16 6
160,000	„	„	4½	Do. 4½ p. c. Pref. Stk., 1875	—	..	—
175,785	„	27 Mar.	4½	Do. 4½ p. c. Deb. Stock	158—163	..	2 15 2
1,719,514	Stck.	15 Apl.	7	East London, Ordinary	243—248	−2	2 16 6
654,740	„	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	157—162	..	2 15 6
100,000	„	„	3	Do. 3 p. c. Deb. Stk.	105—107	..	2 16 1
700,000	50	12 June	7½	Grand Junction, 10 p.c. max.	125—130*	..	2 17 8
280,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	149—153	..	2 12 4
708,000	Stck.	13 Feb.	12	Kent	348—353	+1	3 8 0
160,000	„	„	7	Do. New, 7 p. c. max.	215—220	..	3 3 7
1,043,800	100	30 Dec.	7½†	Lambeth, 10 p. c. max.	275—280	..	2 11 8
406,200	100	„	7½†	Do. 7½ p. c. max.	227—232	..	3 2 6
350,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	147—152	..	2 12 8
500,000	100	13 Feb.	12¾	New River, New Shares	435—440	..	2 18 0
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	154—159	..	2 10 4
902,300	Stck.	12 June	4	S'thwk & V'xhall, Ordinary	165—170*	..	2 7 1
126,500	100	„	4	Do. Do. 7½ p. c. Max.	153—163*	..	2 9 1
489,200	Stck.	„	5	Do. Do. 5 p. c. Pref.	165—170*	..	2 18 10
1,019,585	„	15 Apl.	4	Do. 4 p. c. A Deb. Stk.	147—152	..	2 12 8
1,155,066	Stck.	12 June	10	West Middlesex	322—327*	..	3 1 2
200,000	„	„	4½	Do. 4½ p. c. Deb. Stk.	155—160*	..	2 16 3

† Next dividend will be at this rate. *Ex div.

year of £17,071. The revenue from gas has amounted to £424,612—an increase of £857; and from electric lighting, to £23,033—an increase of £5240. At a meeting of the Corporation on Thursday, Mr. Stevenson, the Sub-Convener of the Gas and Electric Lighting Committee, moved approval of the minutes of his Committee; and Mr. Fife, in seconding, remarked that, considering there was a reduction of 2d. per 1000 cubic feet of gas last year, it was satisfactory that an increase had been experienced. Now, as to these figures, it will be observed that the large drop of £17,071 upon residuals will be a disturbing element in the gas account. On account of the reduction in the price of gas last year, it cannot be made up from sales of gas. It may, however, be met by a lower cost of coal. If the price of gas had not been reduced, the revenue from the sale of it would have been more than £30,000 higher, which would have more than wiped out the decrease. As it is, I expect that there will be a lessened expenditure upon coal of somewhere about £20,000. Of course, this is a rough calculation; but it serves to show that, taking everything into account, there is good ground for expecting that the gas account will leave a surplus. Turning to the electric lighting account, it may be pointed out that, in the year ending in May, 1895, the total expenditure was £22,700, which exceeded the receipts by £1500. The increased revenue this year is not by any means all profit; but, on the other hand, unless capital or other extraneous outlays have been unusually heavy, the account should come out about square. At their meeting on Thursday, the Corporation adopted the recommendation of the Committee to increase the salaries of several officials in the Treasurer's department by from £10 to £25 a year. They also agreed that the maximum pay of outdoor collectors should be advanced from £110 to £120; of indoor collectors, from £175 to £190; of meter inspectors, from £100 to £110; and of survey clerks, from £110 to £120—the advances to be made at the rate of £5 a year, at the option of the Chairman of the Finance Committee, till the maximum is reached.

The Forfar Gas Corporation held two meetings this week. At the first, on Monday, it was reported that there was an increase in the output of gas during the past month of 4100 cubic feet, as compared with the quantity in the corresponding period of last year. The other business was of an ordinary nature. The Corporation met again last night to dispose of the offers which had been received for residual products. At this meeting, our old friend Mr. Christie distinguished himself in a way which should show the electors of the burgh how undesirable it is to place in power a man who does not proceed by reasonable methods. The Corporation had just agreed to let the contract to Messrs. J. Ross and Co., of Falkirk, at 2s. 7d. per ton of coal carbonized, when Mr. Christie, who had mistaken the hour of meeting, entered the room. Mr. Christie said that, had he been present, he would have strenuously opposed the proposal; and when told that they could not reconsider what had been done, he created a scene. Such expressions were addressed by him to his colleagues as "low hound," "impertinent skunk," "grinning ass," and "donkey-like.' Of course, the Corporation did not go back upon their resolution. If Mr. Christie had wished them to do so, he took the wrong way about it; but the more exhibitions he gives of this nature, the less power he should have in the Corporation, or in the community.

The information upon which my statement last week was founded, with reference to the arbitration in connection with the transfer of the Dunfermline Gaslight Company's undertaking, was derived from the Corporation side. It is now corrected by the statement that the Company will not be ready by the end of next month. August is a holiday month; and it is not expected that the reference will take place till September. If this be so, and if the parties wish to be represented by Counsel who will do justice to their case, they had better wait till October. In the beginning of that month they would get any Counsel they pleased; but before then few men of eminence at the bar would care to attend to a matter with respect to which there is no great urgency. The Company are this year, it is said, to announce a 10 per cent. dividend. The customary rate has been 6 per cent.

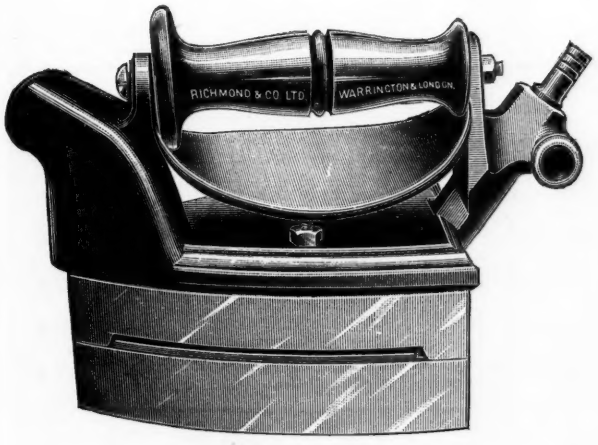
The Milngavie Gas Company held their annual meeting yesterday. During the past year, the output of gas exceeded that during the preceding year by about one million cubic feet. Unaccounted-for gas amounted to 18 per cent.; and it is explained that this high rate is owing to there being 14¼ miles of piping for the distribution of ten million cubic feet of gas. The district supplied is a growing outlying suburb of Glasgow. In 1860, the annual output was only 2½ million cubic feet; and the price was 8s. 4d. per 1000 feet. The charge last year was 4s. 4½d.; and it has now been reduced to 4s. 2d. per 1000 feet. The dividend paid was 5 per cent. A pleasing feature in connection with the Company is that they have had the same Manager (Mr. John Learmouth) for the past 37 years.

The Perth Gas Commissioners have had raised, and have very satisfactorily settled, a question of some importance in reference to the new gasholder they are about to erect. The specification includes a depth of 3 feet of concrete for the foundation of the tank. Ex-Bailie Gow, at one time Convener of the Works Committee of the Commission, thought that a depth of 18 inches should be sufficient. It was proposed in the Commission that local practical men should be got to report on the subject. There was a good deal of talk over the matter; and eventually a suggestion by Lord Provost Dewar was agreed to, but only by a narrow majority, that a representative of the contractors —Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton—should be asked to visit the city and give them his views as to the necessary depth of concrete. Now, it may be that Mr. Gow has had experience in the construction of gasholders, which leads him to his belief. But in this, as in other matters, advance has been made; and it is not to be forgotten that this is to be a wire-rope guided holder, in which case the strains upon the tank walls must be different from what they are in tanks of the old construction. When this is taken into account, the conclusion is a natural sequence that the views of local men—no matter however practical in concreting for ordinary structures—would have been of no value to the Commission.

The Blairgowrie Gaslight Company have paid a dividend at the rate

RICHMOND & CO., Ltd.,

WARRINGTON & LONDON.



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PERFECT COMBUSTION.

Double-Cased and Packed Top, with Asbestos-Lined Shield.

GIVES SPLENDID RESULTS.

of 4 per cent. for the past year, as against 3½ per cent. for the preceding twelve months. The consumption of gas last year was the largest in the history of the Company. The Cumnock Gas Company have paid a dividend at the rate of 7½ per cent. for the past year, and have retained the price of gas at 4s. 2d. per 1000 cubic feet.

On the forenoon of last Saturday, a fire broke out in a fish-curing shed adjoining the gas-works at Stornoway. In the belief that an explosion might occur, the gas was allowed to escape from the holder. The coal-store, containing about 300 tons of coal, was destroyed.

The annual financial statement of the Glasgow Corporation Water Department shows that the revenue from the water-rates for the year amounted to £185,943; from the hydraulic power works, to £743; and from river supply works, to £3026—a total of £189,713. To this falls to be added the balance from last year, £19,485—making a gross total of £209,198. The expenditure, including annuities and interest, amounted to £140,562; for hydraulic power works, to £3341; and for river supply works, to £3956—a total of £147,859. This left a balance of £61,338; and as £36,027 had been transferred to the sinking fund accounts, there was a balance of £25,311 to be carried to the credit of revenue account to meet the compulsory sinking fund on the cost of the new works. The revenue shows an increase of £8409 over the previous year; and the expenditure, of £9081. During the year, £167,749 had been added to capital account, as the amount expended on new works. The capital expended on the new works now being constructed under the Acts of 1882, 1885, and 1892 amounts to £1,235,025; and there are still unexhausted borrowing powers of £284,890. The sinking funds set apart for, and being applied in, the redemption of annuities and in repayment of moneys borrowed in terms of the Acts, now amount to £783,572. The quantity of water sent into the city and district during the year ending May 31 last averaged as follows: From the Loch Katrine works, 43,923,786 gallons per day; from the Gorbals works, 4,640,499 gallons per day—together, 48,564,285 gallons. The average for 1894-95 was 46,866,099 gallons per day; the increase for this year being 1,698,186 gallons per day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 20.

Sulphate of Ammonia.—During the week, there has been more buying going on; and prices have been well maintained. Supplies have, however, been sufficient to meet the demand; and sellers have not been able to score an advance. The quotations remain £7 18s. 9d. f.o.b. Leith and £8 to £8 2s. 6d. f.o.b. other ports. In the forward position, Scotch makers seem more inclined to operate; and there are now sellers up to June, 1897, at £8 10s. f.o.b. Leith. English makers generally, in view of the low level of prices current, and of the largely increased exports, decline to offer ahead. Up to the end of May, the increase in exports over those during the same period in 1895 was about 13,000 tons—that is to say, an increase of 25 per cent.; whereas the exports all 1895 were only 9000 tons in excess of those in 1894.

Nitrate of Soda remains quiet at 7s. 9d. for good, up to 7s. 10½d. for refined quality.

LONDON, *June* 20.

Tar Products.—Although benzols are still nominally quoted at the advanced prices, there are no buyers at the moment who will touch them. It is not unlikely prices may go lower; but a feeling exists in the minds of makers that the requirements of the world are distinctly in excess of present production, and that later on a further improvement is quite probable. Naphthalene and creosote salts continue in good request; and the improved market for creosote oils is also maintained. More business is being done in carbolic acid. Although no important transactions are noted in anthracene, there is a little better feeling in the market; and it is felt that buyers must soon come in to cover their wants. It is difficult to forecast the future of pitch. At the moment, the hot weather is preventing shipments; and buyers do not seem at all anxious about the article. Fortunately, there are no stocks in makers' hands; and, as there is an undoubted improvement in the price of steam coals, producers are hopeful that the substantial prices that have obtained now for at least two years, will be continued. As will be seen by quotations below, there are marked differences between prices being paid for tar contracts, influenced no doubt by the different positions and the quality of it.

Business has been done at the following rates: Tar, 18s. to 25s. Pitch, nominal, 32s. 6d. Benzols, 90's, nominal, 2s. 8d. to 2s. 9d.; 50's, 2s. 3d. Toluol, 1s. 11d. Solvent naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 11d. Creosote, 1¾d. Naphthalene, £3; salts, 35s. Cresylic acid, 1s. 1d. Carbolic, 60's, 2s. Anthracene, nominal, "A," 10½d.; "B," 8d. to 9d.

Sulphate of Ammonia is offered at £7 17s. 6d. to £8 2s. 6d. a ton, according to port of shipment and conditions of delivery, in all cases, excepting Beckton, less 3½ per cent. discount. Gas liquor is offered at 6s. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is nothing of any special moment to notice in connection with gas coals, beyond what has previously been reported. Such further information as comes to hand goes only to confirm what has been stated with regard to the slight giving way in prices this season, as compared with those obtained last year—the general reduction being about 3d. per ton. Perhaps the matter which will most affect tenders which have yet to be sent in is the possible arrangement that may be come to between the coalowners and the miners, with regard to the Conciliation Board. Though some of the largest colliery proprietors in Lancashire are not enthusiastic about continuing the Board—and especially under the conditions with regard to a minimum wage, which the miners are seeking to impose—there is still a more or less general desire not to create any unnecessary rupture; and the arrangements which have been made

NEW "PENNY-IN-THE-SLOT" COOKERS.

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We have given particular attention to the strength and simplicity of these Cookers, which are constructed upon the principle of our celebrated "Eureka" Cooker, and are practically indestructible. They are very easily cleaned, and are all constructed in as many parts as possible, so that, in case of breakage, the parts may be readily and cheaply replaced.

No. 403 and 404.

No.	External Dimensions.			Oven.			Hot Plate.	No. of Boiling-Burners	Price.	White Enamelled Crown extra.
	High.	Wide.	Deep.	High.	Wide.	Deep.				
401	18½	13½	11½	14	11	9½	13½ by 11½	1	28/6	—
402	24½	15½	15	18	11	11	15½ ,, 15	2	40/-	2/6
403	30	18	17	19	11	11	18 ,, 17	2	45/-	2/6
404	30	18	17	19	13½	11	18 ,, 17	2	50/-	2/6
404	If fitted with Enamelled-Lined and Jacketted Door and Fire-Brick Crown, as adopted by The London Gaslight and Coke Co.								55/-	2/6

Any of these Cookers, except No. 401, can be fitted with Griller at an extra charge of 2/6; but the adoption of the Griller is not recommended for use with Prepayment Meters.

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for a joint meeting in London to-morrow (Wednesday), may certainly be taken as an indication that efforts on both sides are being made to come to some agreement, if this is found to be possible. Should a satisfactory agreement be arrived at, which may ensure a peaceful relationship between coalowners and men for another stipulated period, this, of course, must necessarily have some effect upon the prices and conditions under which colliery proprietors would be prepared to enter into contracts over the ensuing twelve months. The general coal trade is passing through about the quietest period of the year; and, though very few collieries are running above four days per week, a considerable quantity is going into stock. House-fire coals necessarily meet with only the most limited demand; and prices are weak and irregular. The lower qualities of round coal are in fair request, for iron-making, steam, and general manufacturing purposes; but supplies continue plentiful, and prices as low as ever. Best Wigan Arley averages 9s. 6d. to 10s. per ton at the pit; Pemberton four-feet and seconds Arley, 8s. to 8s. 6d.; common house coal, 6s. 6d. to 7s.; and steam and forge coals, 5s. 6d. to 6s. Engine fuel is rather scarce, owing to the restricted production of slack, caused by the depression in the round coal trade; and prices show a continued hardening tendency. With regard to the advance of 3d. per ton talked of last week, no general move in this direction has been made.

Northern Coal Trade.—The coming local holidays have had the usual effect on the coal trade of the North; inducing a rather fuller working at most of the pits, and a desire on the part of shipowners to get their vessels away before the stoppage. Thus the work at the pits has been generally rather above the average; and for prompt supplies, the price has been firm. Best Northumbrian steam coals are quoted 8s. 3d. per ton f.o.b.; but there are variations from this price, as the condition of the pits vary. It may be anticipated that a little more scarcity will have its effect on the price during the next week or two. Steam small coals have been more abundant; but the demand has been also increased, so that the quotation is maintained at about 3s. 9d. per ton f.o.b. There has been a rather better demand for manufacturing coals; but it is on old contracts, and the price is unaltered. Gas coals are fairly firm for the season, and a better demand may be now anticipated, though there is no likelihood of any very general movement in price, to the large consumers at least. For single cargoes, the quotation is from 6s. 3d. to 6s. 9d. per ton f.o.b., according to quality. The export of gas coals continues steady. In coke, there is no alteration—the local demand for the blast-furnaces of the North-east being about at its height, and the price being about 13s. 9d. per ton at the Teesside furnaces. Gas coke is dull in price, and unchanged in demand.

Scotch Coal Trade.—There is absolutely no outward change to note. The market for all sorts is very sluggish. It is rumoured that there is so much coal stacked at pitheads, and in railway and other yards, that some coal-owners would welcome trouble with the men, which would have the effect of increasing values. There is little prospect of either taking place, unless outside trade can be got; and with reference to this, it is stated that the prospects of getting back contracts which were lost on account of the strike are brighter than they have been hitherto. The prices quoted are: Main, 5s. 9d. (easy) per ton, f.o.b. Glasgow; ell, 6s. 3d. to 6s. 9d.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. The shipments for the week amounted to 161,297 tons—an increase upon the quantity in the preceding week of 8513 tons, but a decrease on the corresponding period of last year of 14,918 tons. For the year to date, the shipments have amounted to 3,156,543 tons—an increase upon the quantity in the same week of last year of 181,630 tons.

Exhibitions of Gas Appliances.—Messrs. R. and A. Main held an exhibition of gas cooking and heating stoves in the Public Hall, Church Street, Darwen, under the auspices of the Corporation Gas Department, from Tuesday to Friday last week; cookery demonstrations being given twice daily by Miss Parker. The exhibition was thoroughly successful. The Aylesbury Gas Company held an exhibition in the Corn Exchange of that town from the 9th to the 12th inst., under the personal superintendence of the Manager (Mr. G. Lane). There was a large show of stoves by the Davis Gas-Stove Company, Limited, and a varied assortment of burners and globes was provided by Messrs. George Bray and Co. Incandescent gas-lights and lamps and lanterns of several kinds were exhibited, as well as "Surprise" pendants, the incandescent fire-frame, &c. A feature of the exhibition was an effective display of various products made and used in the manufacture of coal gas, which were shown and explained by the Manager, assisted by Messrs. W. T. and A. G. Lane. Miss A. Richards gave cookery demonstrations each afternoon and evening. The exhibition was opened by the Chairman of the Company (G. Butcher, Esq., J.P.). Messrs. W. Parkinson and Co. held a very successful exhibition of gas appliances at the Moseley and Balsall Heath Institute, Birmingham, last week; Miss Edith Sanderson giving practical demonstrations on cookery twice daily.

Colwyn Bay and Conway Joint Water Board.—The Clerk of this authority has received instructions to apply for an additional loan of £8000 to defray the cost of new lines of mains to Colwyn Bay and Llysfaen.

Burslem Corporation Gas Department.—The Burslem Corporation are about to make application to the Local Government Board for sanction to the borrowing of £6000 for the purpose of providing new mains, meters, services, and stoves.

Reduction in the Price of Gas at Heywood.—The Heywood Town Council last Thursday week endorsed a proposal of the Gas Committee to reduce the price of gas 2d. per 1000 cubic feet for lighting purposes, and by 3d. for stoves and motive power.

Gas Lighting at Swanscombe.—The Swanscombe Council have entered into a contract with the Greenhithe Gas Company for lighting the public streets at Swanscombe and Galley Hill for ten consecutive months of the year (June and July being excepted), at a charge of 17s. 4d. per light for the December and March quarters, and 10s. 2d. for the June and September quarters; together with 2s. 3d. per quarter for each lamp for cleaning. The Company will provide and fix the posts, &c.

Hot Water Supply from Gas-Lamp Posts.—A novel application from the Hot Water Supply Syndicate, Limited, was before the Lighting Committee of the Liverpool Corporation last Friday. They asked for permission to erect experimentally three lamp columns and fittings for a period of three months for supplying hot water to the public by means of a coin-freed machine. The method proposes the utilization of the heat given off by the gas burnt in the street lamps; and the hot water is charged for at the rate of a ½d. per gallon. The Syndicate claim that wherever the system has been introduced, it has been a boon to the working classes. The Committee acceded to the application, and left all the arrangements for the experiment in the care of Mr. Bellamy, the Gas Inspector and Superintendent of Street Lighting.

Gas for Public Lighting at St. Mary Church.—The Gas Committee of the St. Mary Church District Council decided at their last meeting to reduce the price of gas for public lighting to 4s. 6d. per 1000 feet, provided the lamps were lighted all the year round. The matter was considered at the last meeting of the Council, when it was explained that the Committee went thoroughly into the matter. A statement which they received from the Gas Manager showed that, under existing arrangements, with the lamps lighted for about nine months of the year, the consumption was 7000 cubic feet per annum; and that lighted all the year round it would be 9000 cubic feet. With the proposed reduction in price, they would cost for the whole year practically the same as they cost before. An amendment to refer the question back to the Committee was negatived; and the recommendation was adopted.

Bicester Water Supply.—A special meeting of the Bicester District Council was held a short time ago to consider a letter from the Local Government Board on the subject of the Bicester water supply, to which Dr. T. Thomson, the Board's Inspector, who some time since made an inquiry into an outbreak of enteric fever, attributed the prevalence of the fever to be mainly due; and also to receive the report of Messrs. Hunt and Fane, two members of the Council, who had been delegated to visit Brackley and Stoney Stratford, and inspect the water-works of those towns, with the view to gleaning information which might be of use to the Council. The letter and report having been duly read and considered, Mr. Walsh proposed—"That the Council at once proceed to employ a competent engineer to formulate, and present to the Council as early as possible, a scheme for providing the town of Bicester with pure water." Mr. Goble seconded the proposition; and it was carried without a division. Mr. Finch moved and Mr. Fane seconded a proposition that Mr. E. S. Fawcett, an engineer who was staying in the town, should be asked to attend before the Council. This also was carried. The attendance of Mr. Fawcett having been secured, he explained that he would be pleased to make a survey of the town and surrounding district, and prepare a report, plans, and estimates for supplying the town with water. He would agree to make no charge beyond actual out-of-pocket expenses, which he would undertake should not exceed £10, in the event of his scheme or recommendations not being adopted and carried out; but should they be approved, he would ask to act as the engineer at the usual fees, charged on his estimate. His scheme, he promised, would be in accordance with the requirements of the Local Government Board. It was unanimously agreed that, subject to satisfactory references being given, Mr. Fawcett be asked to make, on the conditions proposed by himself, a preliminary survey of the district, with a view to providing a water supply for Bicester. The proceedings are instructive, and we record them as showing what engineering has come to.

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J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: 'GWYNNEGRAM, LONDON." Telephone No. 65,095.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

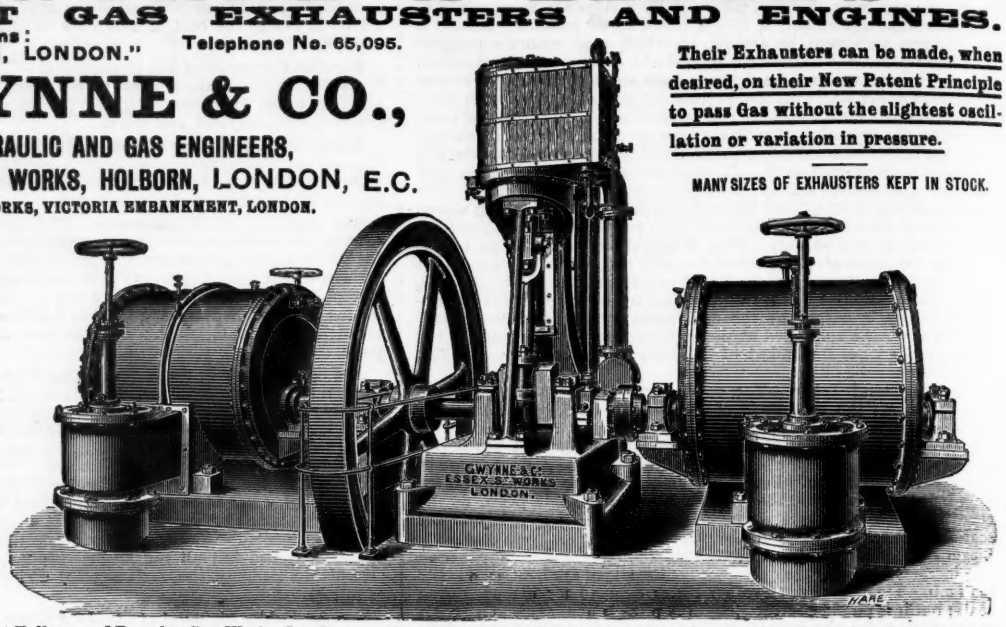
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

It is Worth Your While to Buy DIRECT.
THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.
RELIANCE LUBRICATING OIL COMPANY, WATER LANE, GREAT TOWER, LONDON, E.C.
Depôts at Liverpool, Bristol, Hull, Glasgow and Newcastle-on-Tyne. Telegrams: "Subastral, London."

WANTED, a Situation by a thoroughly experienced Man. Can take Meters, collect Accounts, lay Mains and Services, fix Stoves and Meters, and do General Fitting. At present Working Manager. Age 27; Married. First-class Testimonials.
Address No. 2670, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young married Man (Total Abstainer), a Situation as MANAGER of Gas-Works. Eight years' Manager in Canada. Used to Engine, &c. Can lay Mains, Services, fix Meters, and do all Mechanical Alterations and Repairs in or out of Works.
Address SQUIRE, care of A. Thomas, Gas-Works, COWES.

WANTED, a permanent Situation as GAS-FITTER and MAIN and SERVICE LAYER. Has a practical knowledge of the Manufacture and Distribution of Gas, including Meter Index taking, and Retort setting. Twenty years' Experience.
Address No. 2669, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities, specially prepared for Carburetting. SOLAR OIL for Gas Making Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS.
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

SULPHATE OF AMMONIA SATURATORS.
WALTER THOMASON and SONS,
Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.
J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

HYDRATED OXIDE OF IRON.
PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

WORKS CHEMIST.
YOUNG Man wanted. Preference given to one experienced in Gas Manufacture and Tar Distilling.
Apply, by letter, to No. 2671, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady practical Working Man, fully conversant with Gas Making, to take charge as MANAGER of Gas-Works in small country town. House provided.
Apply, by letter, to No. 2668, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WATFORD GAS AND COKE COMPANY.
WANTED, a competent Man (under the supervision of the Manager) to take Readings of Meters, Inspect all Mains, Services, and Coin Fittings, and to make himself generally useful.
Applications, in own handwriting, stating Wages required, with References as to character from present or late Employer, to be addressed to the undersigned.
WILLIAM ROWELL,
Secretary.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH,
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.
THE LAW GUARANTEE & TRUST SOCIETY, LD., GUARANTEES FIDELITY.
SEND for complete Prospectus containing Balance-Sheet, Copy of Policy, &c., &c. Mortgage, Debenture, License, and Contingency Insurance.
Head Office: 49, CHANCERY LANE, LONDON, W.C.

ECONOMY IN PURIFICATION.
INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

WANTED, at once, a steady Man as GAS-FITTER. Must be well up in the work; and competent to fill up time at Main and Service laying. None need apply who have not been employed by a Gas Company in a similar capacity. Wages to commence, 25s. per week
Apply, with Testimonials, to the MANAGER, Gas-Works, BEXHILL-ON-SEA.

SELF-LOCKING SAFETY GAS-TAP.
THE Patent Rights in Major Skelton's SAFETY TAP (see "JOURNAL OF GAS LIGHTING," March 24, 1896, p. 621) are for disposal.
A Model may be seen on application to Mr. W. H. HARVEY, 17, Old Queen Street, WESTMINSTER, S.W.

MALMO, SWEDEN.
INTERNATIONAL COMPETITION FOR PROPOSALS FOR NEW GAS-WORKS.
THE Board of the Malmo Corporation Gas-Works invite PROPOSALS for the erection of new GAS-WORKS in Malmo.
Plans, and Programme, in the Swedish, English, or German Language, may be obtained on application to the Gas-Works Office.
Three Prizes—viz., 3000, 2000, and 1500 Swedish Crowns—will be given to the successful Competitors.
Proposals to be delivered not later than the 1st day of November, 1896.
For each Programme a fee of Three Swedish Crowns is charged, which must accompany the application.
THE BOARD OF THE GAS-WORKS.
Malmo, May, 1896.

GAS PLANT.

WANTED, second-hand Purifiers of not less than 6 feet or more than 10 feet square.

Two PURIFIERS, 5 feet by 4 feet, FOR SALE.

Apply W. A. DEAS, Solicitor, COLDSTREAM.

FOR IMMEDIATE SALE—A 60-foot diameter TELESCOPIC GASHOLDER, with eight Cast-Iron Columns, in good working order.

To treat for, and view the same, apply to W. C. HOLMES AND Co., Gas Engineers and Contractors, HUDDERSFIELD.

FOR SALE—One single-lift Gasholder, 50 feet diameter 20 feet deep, with Cast-Iron Tank, 51 ft. 6 in. inside diameter 20 feet deep, six Guide Columns and Wrought-Iron Top Bracing, 8-inch Inlet-Pipe and Valve, and 12-inch Outlet-Pipe and Valve, complete with Syphons.

The Cast-Iron Tank is strongly stayed, with Wrought-Iron encircling Straps on the outside; and, if not used for its present purpose, it would make a suitable Storage Tank for a small Water-Works.

Two vertical MULTITUBULAR GAS-HEATED STEAM-BOILERS, 3 feet diameter, 18 feet high, with 25 3-inch Steel Tubes, suitable for a working pressure of 80 lbs., complete with Steam and Water Fittings.

One GAS WASHER, 4 feet by 4 feet by 12 feet high.

One Samuelson and Co.'s "O" Size "ACME" EXHAUSTER and 14 in. by 14 in. DUPLEX ENGINE combined, having a capacity of about 10,000 cubic feet per minute.

The above Plant has only worked a short time, and is almost new. No reasonable offer for the whole or any part of it will be refused, as it has to be cleared away at once to make room for further extensions.

Apply to THOS. FIRTH AND SONS, LIMITED, Norfolk Works, SHEFFIELD.

KINGTON GAS COMPANY.

THE Company are prepared to receive TENDERS for the supply, during the Twelve Months from the 30th inst. to the 30th of June, 1897, of from 400 to 500 Tons of best screened GAS COAL, in quantities and at times to suit requirements of the Company.

Tenders to be forwarded to Messrs. TEMPLE and PHILPIN, Solicitors, Kington, HEREFORDSHIRE.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR COAL AND CANNEL.

THE Directors of the Radcliffe and Pilkington Gas Company invite TENDERS for about 10,000 Tons of GAS COAL and CANNEL.

Particulars may be obtained from the undersigned, to whom tenders, properly endorsed, must be delivered on or before Friday, the 26th inst.

JAMES BRADDOCK,
Manager and Secretary.

Gas Offices, Radcliffe,
June 10, 1896.

TO COLLIERY PROPRIETORS, MERCHANTS, &c.

THE Directors of the Holyhead and North Wales Gas and Water Corporation, Limited, are prepared to receive TENDERS for the supply of COAL to their various Gas-Works.

Forms of Tender and full Particulars may be had on application to the Company's Engineer, Mr. G. E. Saville, Farrar Road, Bangor.

Sealed tenders to be sent in to this Office, endorsed "Tender for Coal," not later than Tuesday, the 30th of June inst.

By order,
W. H. SINCLAIR,
Secretary.

9, 10, 11, "Examiner" Buildings,
Manchester.

WALLINGFORD GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Wallingford Gaslight and Coke Company, Limited, invite TENDERS for the supply for One Year, from the 13th of August next, of about 900 Tons of best screened GAS COAL, to be delivered free, at the Railway Station at Wallingford, in such quantities and at such times as the Company may require.

Payments monthly.

Sealed tenders, endorsed "Tender for Gas Coal," to be delivered on or before the 31st of July next.

The Company do not bind themselves to accept the lowest or any tender.

By order,
JOHN CARTHEW,
Secretary.

Wallingford, June 23, 1896.

RAMSGATE CORPORATION.

WATER-WORKS.

THE Council desire Tenders for new BUILDINGS, comprising Engine-House, Boiler-House, Workshop, Stores, and Offices, also Station Superintendent's House, to be erected at their Whitehall Station.

Drawings and Specification may be seen on application to William A. M'Intosh Valon, Engineer, at his Ramsgate Office, and copy of the Quantities obtained on depositing £3 3s., which will be returned on receipt by the Corporation of a *bond-fide* tender.

Tenders to be sent in not later than Ten a.m., on Monday, July 6, addressed to the Chairman of the Gas and Water Department, and endorsed "Water-Works New Buildings."

The Council do not bind themselves to accept the lowest or any tender.

W. A. HUBBARD,
Town Clerk.

EDINBURGH AND LEITH CORPORATIONS GAS.

THE Edinburgh and Leith Corporations Gas Commissioners are prepared to receive OFFERS for a Pair of VERTICAL ENGINES (Cylinders 12 inches diameter, by 24 inches stroke, Fly-Wheels 8 feet diameter), with Framing, Gearing, and Shafting; also Two GAS-EXHAUSTERS of about 50,000 cubic feet capacity each per hour.

These are to be removed to make room for others of larger size, and may be seen at the Gas-Works, Baltic Street, Leith, daily (except Saturdays), from Ten a.m. to Four p.m.

Offers to be sent to the undersigned not later than Saturday, the 4th of July.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
June 15, 1896.

BOROUGH OF ABERAVON.

TENDERS FOR CANNEL.

THE Corporation of Aberavon are pre. pared to receive TENDERS for the supply of 200 Tons of good CANNEL COAL, delivered in Trucks, either at the Port Talbot Station of the G.W.R. Company, or at the Aberavon Station of the R.&.S.B.R. Company, in such quantities as their Gas Manager may require.

Sealed tenders, marked "Cannel," to be sent in to me on or before the 29th of June inst. No Form of Tender supplied.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
M. TENNANT,
Town Clerk.

Aberavon, June 16, 1896.

TIPTON GAS-WORKS.

COAL CONTRACTS.

THE Gas Committee of the Tipton Urban District Council are prepared to receive TENDERS for the supply of GAS COAL, for a period of One, Two, or Three Years, from the 1st of July next, to be delivered, carriage free, to the Gas-Works Siding (L. & N. W. Railway).

Specifications and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.

Sealed and endorsed tenders to be sent to me the undersigned not later than Ten a.m. on Saturday, the 27th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
GEO. M. WARING,
Clerk to the Council.

Public Offices, Tipton,
June 8, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

BY ORDER OF THE DIRECTORS OF THE SOUTHEND GAS COMPANY.

SALE OF 400 SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, London, E.C., on Monday, July 6, at Two o'clock, in lots varying from Five to Ten Shares in each lot, 400 £10 SHARES (fully paid) in the SOUTHEND GAS COMPANY, ranking for a Standard Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at this rate.

Particulars of the SECRETARY, at the Offices, SOUTHEND; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the Aldershot Gas and Water Company, the Directors of the Colonial Gas Association, Limited, and other Owners.

GAS and WATER STOCKS, SHARES, and DEBENTURES IN THE FOLLOWING COMPANIES:—

Aldershot Gas and Water Company,
Commercial Gas Company.
Colonial Gas Association, Limited,
Lambeth Water-Works Company,
Wandsworth and Putney Gaslight and Coke Company,
Kingston-on-Thames Gas Company,
Belgrano (Buenos Ayres) Gas Company,
Lowestoft Water, Gas, and Market Company,
Hornsey Gas Company,
Great Yarmouth Water-Works Company,
Dorking Gas Company,

To be SOLD by AUCTION, by

MR. ALFRED RICHARDS, at the Mart, Tokenhouse Yard, E.C., on Monday, June 29, at Two o'clock precisely, in Lots.

Particulars may be obtained at the Mart; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HARROGATE GAS COMPANY.

SALE OF NEW ORDINARY SHARES OF £10 EACH BY TENDER.

THE Directors of the Harrogate Gas Company are prepared to receive, not later than Twelve o'clock noon, on Wednesday, the 1st day of July, 1896, TENDERS for any number, not exceeding 286 or less than 5, of NEW ORDINARY SHARES of £10 each, which, when paid up, will be consolidated with existing "C" Stock.

Forms and Conditions of Tender may be obtained at the Gas Office, Harrogate, or will be sent by post on application.

By order,
H. WILKINSON,
Secretary and General Manager.

Gas Offices, James Street, Harrogate,
June 9, 1896.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

All Sizes of Elevators and Conveyors of every class, for Coal, Coke, Mechanical Stoking, and all other purposes, made and erected by the NEW CONVEYOR COMPANY, LTD., Transport Appliance Works, SMETHWICK.

(ALL NEW PATTERNS)

BIRMINGHAM.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,
— *v* —
"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.
— *v.* —
"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared **VALID ON ALL POINTS** after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a **"PIONEER INVENTION."**

SCOPE OF PATENT. The Patent **HAS BEEN GIVEN A WIDE CONSTRUCTION**; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), **IS STILL AN INFRINGEMENT** of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an **INJUNCTION, WITH FULL COSTS**, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given **AGAINST** the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the **VALIDITY OF THE PLAINTIFFS' PATENT.**

"SUNLIGHT" MANTLES. Last about **100** hours.

"WELSBACH" MANTLES. Last about **1000** hours.

"Sunlight" Mantles **BURN DOUBLE THE GAS** to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to **REPLACE THEM BY THEIR OWN MANTLES.**

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners **ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.**

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, **IN ALL CASES, BE RIGOROUSLY ENFORCED.**

INFRINGERS. The Incandescent Gas-Light Company **WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT, WHETHER**
MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company **ARE INFRINGERS.**

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.
Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

NOTICE.

The attention of the **METEOR INCANDESCENT LIGHTING COMPANY, LIMITED**, having been again called to the Advertisements inserted in various papers by the Incandescent Gas-Light Company, Limited, of Palmer Street, Westminster, to the effect that the "Meteor" Incandescent Gas-Lights are an Infringement of their Patents, and that they will bring Actions for Infringement against all persons found dealing in any manner with such Lights, the **METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, HEREBY GIVE NOTICE** that they are advised that the "Meteor" Incandescent Lights in no way infringe any of the Patents of the Incandescent Gas-Light Company, Limited, that an action has been commenced to restrain such threats, and that they are **PREPARED TO FULLY INDEMNIFY ALL PURCHASERS, DEALERS, AGENTS, and USERS** of their Lights against any Legal Proceedings on the part of the Incandescent Gas-Light Company, Limited.

WILSON, BRISTOWS, & CARPMAEL,
1, Copthall Buildings, London, E.C.,
Solicitors to the Meteor Incandescent Lighting Company, Limited, of 35, New Broad Street, London, E.C.

Nov. 30, 1895.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

LOW MOOR BLACK BED

GAS COAL.

YIELD OF GAS PER TON - 10,375 CUBIC FEET.
ILLUMINATING POWER - 17·50 SPERM CANDLES.
COKE - - - - - - - - 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

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RAVENS LODGE AND CONYERS' COLLIERIES,
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A TRIAL IS RESPECTFULLY SOLICITED.

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FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

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Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
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Highest Results in Gas, & Excellent Coke.

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OUGHTIBRIDGE, near SHEFFIELD,

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The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

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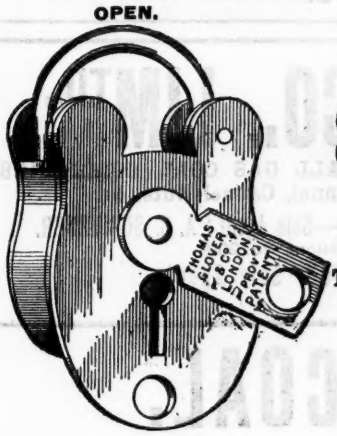

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
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Shipments Promptly and Carefully Executed.
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HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

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RICH IN ILLUMINATING POWER AND YIELD OF GAS.
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MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

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Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,
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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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MACHINE-MADE GAS-RETORTS.

Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.

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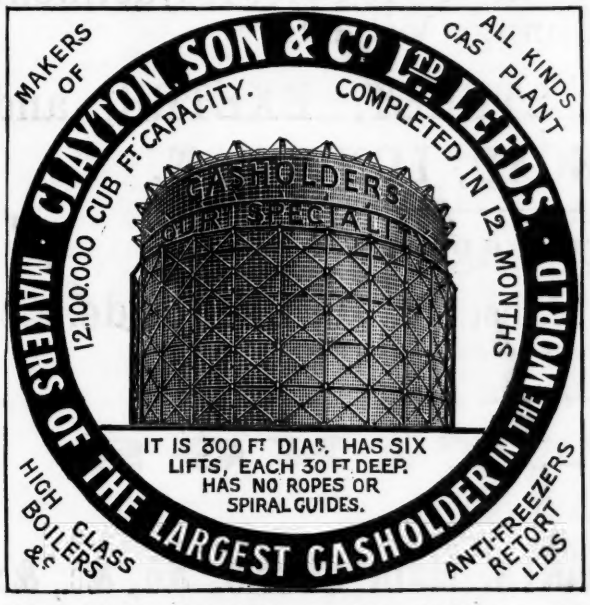
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COMPLETED IN 12 MONTHS
GASHOLDERS
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IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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Patent Automatic Machinery
FOR
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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, June 2, p. 1204.]

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A 280-CANDLE POWER PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT less than half the price of any other Regenerative Lamp.
Manufactured in England.

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At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Liverpool	2,500,000 Cub. Ft.
Belfast	1,700,000 „	Brighton	1,250,000 „
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Santiago	400,000 „	Southport	750,000 „
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Tottenham	600,000 „	Newburgh, N.Y.	350,000 „

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	Manchester	3,000,000 Cub. Ft.
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Tottenham (Second Contract)	750,000 „	St. Joseph, Mo.	750,000 „
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In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

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[See Illustrated Advertisement, June 2, p. 1243.]

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HIGHEST EFFICIENCY WITH GREATEST ECONOMY.

LIGHTING AUTHORITIES, GAS ENGINEERS, & GAS MANAGERS

Are invited to inspect the

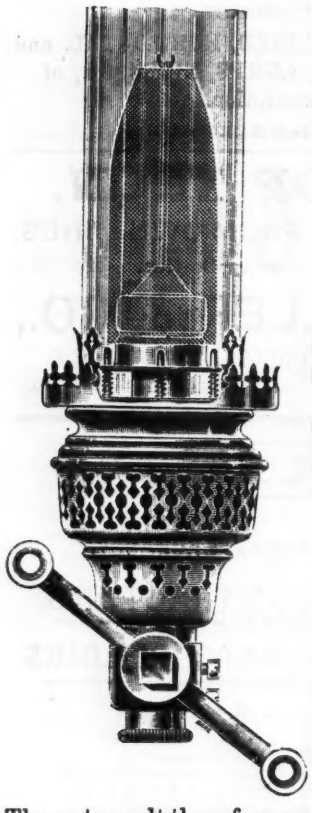
INCANDESCENT GAS-LIGHT

Which has now been successfully adapted to the purposes of

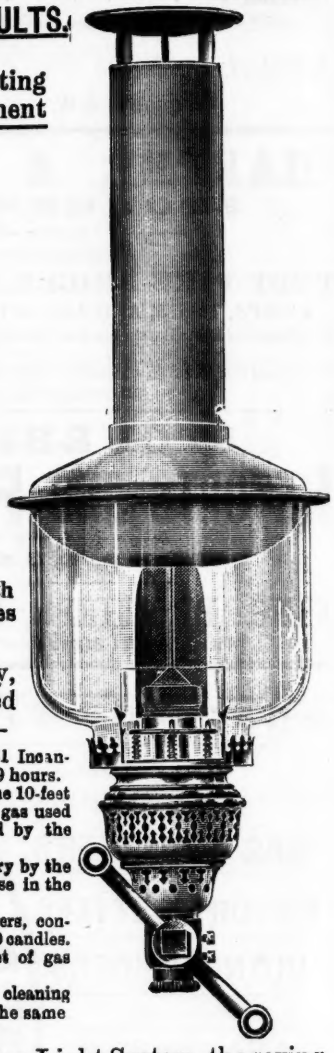
STREET LIGHTING,

THE DIFFICULTIES CAUSED BY VIBRATION HAVING BEEN OVERCOME BY THE USE OF A SPECIAL BURNER, WHICH GIVES HIGHLY SATISFACTORY RESULTS.

This System of Lighting meets the Requirements of all the Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting, without any increase of expenditure.



LARGE REDUCTION IN PRICES FROM THE 2nd of MARCH, 1896.



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The Lighting Engineer of the Kensington Vestry, in a report dated the 14th of May, 1895, addressed the Works and Sanitary Committee as follows:—

(1) During the months of January, February, and March, 1895, 31 Incandescent Gas-Lamps were in use for an average period of 1167·89 hours. The estimated quantity of gas that would have been consumed by the 10-feet flat-flame burner was 11,678 cubic feet. The actual quantity of gas used by the Incandescent Gas-Light Company's Burners, as recorded by the meters, was 4415 cubic feet.

After allowing for the extra cost of up-keep, the gain to the Vestry by the use of these burners was £20 3s. 4½d., and a large increase in the Illumination of the Street.

(2) The illuminating power given by the Incandescent Gas-Burners, consuming 3·78 cubic feet of gas per hour, was found to be equal to 60 candles. That given by the flat-flame burners, consuming 10 cubic feet of gas per hour, was 26 candles.

The lanterns fitted with Incandescent Burners only require cleaning 9 times in 90 days, as compared with 26 times' cleaning in the same period required by the lanterns filled with flat-flame burners.

The net result therefore appears to be that, by the use of the Incandescent Gas-Light System, the saving effected is 15s. per lamp for this quarter, after paying for the up-keep of the Burner, and at the same time more than double the light is obtained. It must be noted, however, that these results were obtained with the ordinary burners, and not with the improved burners with the anti-vibration springs. With the latter, the expense of up-keep would be materially reduced, and the saving consequently increased.

For further Particulars, apply to

THE INCANDESCENT GAS-LIGHT COMPANY, LTD.,
PALMER STREET, WESTMINSTER, LONDON, S.W.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THE PEEBLES PROCESS.

The Oil Gas Enrichment Company's Patents.

This Process for Enriching Coal Gas has now been adopted by nearly 50 Gas-Works at Home and Abroad, and continues to give complete satisfaction.

VERY LARGE PROFITS HAVE ACCRUED AT GAS-WORKS WHERE IT IS IN OPERATION; AND THE TROUBLE ARISING FROM NAPHTHALENE DEPOSITS HAS BEEN REMOVED.

Reference is kindly permitted to the Engineers of the following Gas-Works:

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For further Particulars, apply to the Licensees—

R. & J. DEMPSTER, Ltd.

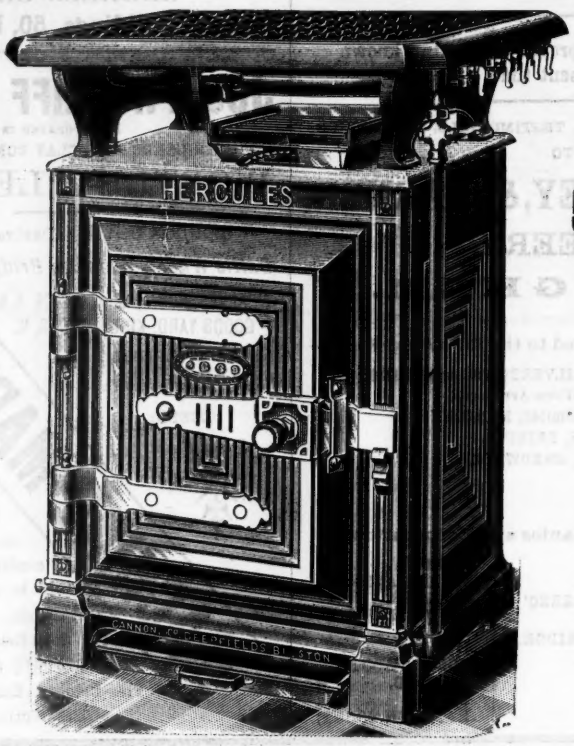
GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

*** **Please note that our Advertisements will in future regularly appear in this space—viz., the inside of the last leaf of the JOURNAL—to facilitate reference by our customers.**

CANNON GOLD-MEDAL "HERCULES" GAS-COOKER.

THE BEST STOVE FOR HIRING OUT.

CAST-IRON ENAMELLED INTERIORS.



COSTS AT LEAST 50 Per Cent. LESS FOR MAINTENANCE.

STRENGTH AND DURABILITY.

IMPORTANT TO GAS COMPANIES.

This Gas-Cooker has met the demand of Gas Companies for a Cast-Iron Gas-Cooker with an interior of **PURE PORCELAIN ENAMEL.** This Cast-Iron Enamel is the result of a special process known as "Porceliron."

ADVANTAGES OF CAST-IRON ENAMELLED INTERIORS.

1. **Superiority over Enamelling on Sheet Iron; Strength and Durability being obtained.**
2. **Will not chip or wear away.**
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By using the "Hercules" Gas-Cooker, you have a Stove which will last longer than any other Cooker in the Market. We have met with perfect success; and for the purpose of directly bringing this Cooker before Gas Engineers, we are willing to send any size Cooker for inspection.

No.	Inside Dimensions of Oven.			Hot-Plate.	Height over all.	Burners on Hot-Plate.	Average Cost three meals per day. Gas 3s. 6d. per 1000 c. f.	List Price with interior Enamelled complete, and Enamelled Crown Plate.
	High.	Wide.	Deep.					
2013	26-inch	12-inch	10-inch	21 by 17½-inch	36-inch	2	2d.	£4 12 6 each.
2014	26 ,,	14 ,,	12 ,,	23 ,, 19½ ,,	36 ,,	3	2d.	5 15 0 ,,
2015	26 ,,	16 ,,	14 ,,	25 ,, 21½ ,,	36 ,,	4	2½d.	6 10 0 ,,
2016	26 ,,	18 ,,	16 ,,	27 ,, 23½ ,,	36 ,,	5	3d.	7 13 6 ,,
2017	26 ,,	20 ,,	18 ,,	29 ,, 25½ ,,	36 ,,	6	3d.	9 4 0 ,,
2018	26 ,,	22 ,,	20 ,,	31 ,, 27½ ,,	36 ,,	7	4½d.	12 10 0 ,,
2019	26 ,,	24 ,,	22 ,,	33 ,, 30½ ,,	36 ,,	8	6d.	13 5 0 ,,

NOTE.—No extra charge for Enamelled Crown Plate. The Shelf Rests are Enamelled without extra charge.

THE CANNON HOLLOW-WARE CO., Ltd.,

DEEPFIELDS, Near BILSTON, STAFFS.

London Show-Rooms: 58, HOLBORN VIADUCT, E.C.

Established 1826. Send for COMPLETE LIST (Post Free).

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